



## DEGREE AND CERTIFICATE REQUIREMENTS

Linn State Technical College offers the following degree and certificates:

- Associate of Applied Science Degree
- Certificate – One-Year
- Certificate – Less than One-Year
- Certificate – Less than One Semester

### ASSOCIATE OF APPLIED SCIENCE DEGREE

The associate of applied science degree is awarded to a student who completes a general education core and a comprehensive series of technical courses designed to prepare the student for employment in a specific career. The associate of applied science degree may also be recognized for transfer by four year colleges and universities.

Linn State Technical College offers an Associate of Applied Science degree in the following areas:

Automation & Robotics Technology

Automotive Collision Technology

Automotive Technology

General Option

Electric/Hybrid Vehicle Option

High Performance Option

Light-Duty Diesel Option

Aviation Maintenance

Business Systems Specialist

General Option

Automated Accounting Systems Option

Commercial Turf & Grounds Management

Computer Programming

General Option

Web Design Option

Construction & Civil Technology

Design Drafting Technology

Electric Power Generation Technology

Electrical Distribution Systems

Electronics Engineering Technology

General Option

Biomedical Engineering Technology Option

Heating, Ventilation, & Air Conditioning Technology

Heavy Equipment Technology

General Option

CAT Dealer Service Technician Option

Industrial Electricity

Construction Emphasis

Electronic Controls Emphasis

Programmable Logic Controllers Emphasis

Industrial Maintenance Technology

Machine Tool Technology

Medium/Heavy Truck Technology

Networking Systems Technology

General Option

Telecommunications Option

Nuclear Technology

Radiation Protection Option

Instrumentation and Control Option

Reactor Operations Option

Quality Control Option

Physical Therapist Assistant

Powersports Technology

Welding Technology



### CERTIFICATES

A certificate is awarded to students who complete a series of courses designed to develop a job skill or competency.

Linn State Technical College offers Certificates in the following areas:

- |  |   |
|--|---|
| Automation & Robotics Technology               | Business Systems Specialist – One-Year                        |
| Machining Specialist – Less than One-Year      | Commercial Turf & Grounds Management                          |
| Electrical Specialist – Less than One-Year     | Turfgrass Management – One-Year                               |
| Automotive Collision Technology                | Landscape Management – One-Year                               |
| Refinishing & Non-Structural Repair – One-Year | Electric Power Generation Technology – Less than One Semester |
| Structural & Mechanical Repair – One-Year      | Heavy Equipment Operations – One-Year                         |
| Automotive Technology                          | Industrial Electricity  |
| Automotive Transmission/Transaxle – One-Year   | Electromechanical – One-Year                                  |
| Maintenance & Light Repair – One-Year          | Networking Systems Technology – One-Year                      |
| Engine Performance – One-Year                  | Welding Technology  |
| General Automotive – One-Year                  | Basic Welding – Less than One Semester                        |
| Aviation Maintenance                           | Entry-Level Welding – One-Year                                |
| Powerplant – One-Year                          | Advanced-Level Welding – Less than One Semester               |
| Airframe – One-Year                            |   |

### COURSE PREFIXES

The following is a list of the course prefixes and definitions included in this catalog.

- |     |   |     |                                   |
|-----|---|-----|-----------------------------------|
| ACC | Accounting  | IMT | Industrial Maintenance Technology |
| ACT | Automotive Collision Technology                     | MAR | Automation & Robotics Technology  |
| AMT | Automotive Technology                               | MAT | Mathematics                       |
| ASC | Associated Science Course                           | MHT | Medium/Heavy Truck Technology     |
| BUS | Business Systems Specialist                         | MNT | Nuclear Technology                |
| CAT | CAT Dealer Service Technician (HET Option)          | MPT | Metal Processing Technology       |
| CCT | Construction & Civil Technology                     | MSC | Military Science Course           |
| COM | Communication                                       | MTT | Machine Tool Technology           |
| CPP | Computer Programming                                | NST | Networking Systems Technology     |
| CTG | Commercial Turf & Grounds Management                | PHY | Physics                           |
| DDT | Design Drafting Technology                          | PSC | American Government               |
| EDS | Electrical Distribution Systems                     | PST | Powersports Technology            |
| EET | Electronics Engineering Technology                  | PSY | Psychology                        |
| EMS | Engineering/Mathematics/Science                     | PTA | Physical Therapist Assistant      |
| ENT | Entrepreneurship                                    | SEM | Seminar                           |
| EPG | Electric Power Generation Technology                | SPM | Self-paced Mathematics            |
| HEO | Heavy Equipment Operations                          | TAM | Aviation Maintenance              |
| HET | Heavy Equipment Technology                          | WLD | Welding                           |
| HST | History   | WLT | Welding Technology                |
| HVT | Heating, Ventilation, & Air Conditioning Technology |     |                                   |
| IEL | Industrial Electricity                              |     |                                   |



## **COURSE REQUISITES**

Some courses at Linn State Technical College have prerequisite, corequisite, and/or concurrent requisite requirements. Requisite requirements are included in the course description for each course to which they apply. Enrollment in a course with a requisite requirement is not permitted until the requisite requirement is satisfied. The various types of course requisites are defined below:

- **Prerequisite.** A course or requirement that must be completed prior to enrollment in a given course.
- **Corequisite.** A course or requirement that must be completed prior to or at the same time as enrollment in a given course.
- **Concurrent requisite.** A course or requirement that must be completed at the same time as enrollment in a given course.

## **CATALOG YEAR**

The semester that students enter college is stored in the LSTC student information system database. This permanent record is referred to as the student's catalog year and provides the degree or certificate graduation requirements that a student will follow to reach his/her goal. The student who does not remain continuously enrolled has two calendar years to complete all graduation requirements and apply for graduation. After two calendar years, the student must reapply for admission under the catalog requirements in effect at that time. Students who change majors at LSTC are subject to the degree or certificate graduation requirements in effect on the date that the change of major becomes effective.

In order to meet accrediting standards or to upgrade course offerings, the degree requirements specified by the catalog the student is enrolled under may be modified under certain conditions.

## **GENERAL EDUCATION REQUIREMENTS**

**Philosophy of General Education.** The college aims to prepare students to perform effectively in highly specialized and advanced technical occupations and respond effectively to the inevitable technical and societal changes that will occur throughout their careers. To respond to change, students will need to engage in a lifelong process of inquiry, decision-making, and acquisition of new knowledge. General education, which has as its fundamental purpose the development and integration of every student's knowledge, skills, attitudes and experiences, is one of the best means for achieving the ability to engage effectively in critical thinking and problem solving needed in the work place and beyond.

The required General Education courses assure that students have a sound base in oral and written English, mathematics, the sciences, and computing skills.

A key characteristic of the curriculum for each program is the integration of academic and technical education into a balanced program of study designed to develop broad-based, highly-skilled technicians. This requires that the student develop a foundation of communication, mathematics, science, and social knowledge and skills, as well as developing appropriate attitudes associated with successful technicians. This foundation is provided by completion of the required general education courses. The knowledge and skills developed are then integrated into technical education courses for purposes of reinforcement and for purposes of connecting the material learned to specific applications in the student's field of study.

**The Associate of Applied Science General Education Core.** Students seeking an Associate of Applied Science Degree are required to take a general education core including a minimum of 19 semester credit hours:

**ASSOCIATE OF APPLIED SCIENCE GENERAL EDUCATION CORE REQUIREMENTS**

Area 1. Oral & Written Communication - 6 Credit hours		
Course #	Course Title	Credits
COM 101	English Composition	3
	Or	
COM 110	Honors Composition*	3
	And	
COM 111	Oral Communications	3
	Or	
COM 121	Public Speaking	3
Area 2. Mathematics - 3 Credit Hours		
MAT 115	College Algebra	3
	Or	
MAT 116	College Algebra Using Mathematical Modeling	3
	Or	
MAT 118	Survey of College Mathematics	3
	Or	
MAT 120	Pre-Calculus	5
	Or	
MAT 122	Elements of Calculus	3
	Or	
MAT 123	Calculus I	5
Area 3. Science - 4 Credit Hours		
PHY 100	Physical Science with a laboratory	4
	Or	
PHY 101/102	College Physics with a laboratory	4
	Or	
PHY 103/104	Environmental Science with a laboratory	4
	Or	
PHY 201	General Physics with a laboratory	5
	Or	
	A science course with a laboratory*	4
Area 4. Social Science - 3 Credit Hours		
PSC 101	American Government <sup>1,2</sup>	3
	Or	
HST 105	American History to 1877 <sup>1,2</sup>	3
	Or	
HST 110	American History from 1877 to the Present <sup>1,2</sup>	3
Area 5. Technical Literacy - 3 Credit Hours		
CPP 101	Introduction to Microcomputer Usage	3
	Or	
CPP 102	Advanced Microcomputer Usage	3

\* Requires Department Approval

<sup>1</sup> PSC 101 American Government, HST 105 American History to 1877, and HST 110 American History from 1877 to the Present fulfill both the general education requirement and Missouri's constitution requirement.

<sup>2</sup> Transfer students must also meet Missouri's constitution requirement through an approved method.



**The Certificate General Education Core.** Students seeking a certificate will follow the specific general education core requirements below for the certificate being sought.

### **CERTIFICATE GENERAL EDUCATION CORE REQUIREMENTS**

#### **Certificate – One-Year**

Students are required to complete a basic general education core of at least six semester credit hours. These general education core courses are selected from: COM 101 or higher and CPP 101 or higher

#### **Certificate – Less than One-Year**

Certificates of Less than One-Year may or may not include a requirement for students to complete a basic general education core of at least six semester credit hours. These general education core courses are selected from: COM 101 or higher and CPP 101 or higher

#### **Certificate – Less than One Semester**

Certificates of Less than One Semester may or may not include a requirement for students to complete a basic general education core of at least six semester credit hours. These general education core courses are selected from: COM 101 or higher and CPP 101 or higher

## **GENERAL EDUCATION AND RELATED COURSES**

The courses listed below are categorized as follows: Accounting, Communication, Engineering/Mathematics/Science, Entrepreneurship, Mathematics, Military Science, Science, Seminar, Social Science, Technical Foundation, and Technical Literacy. Course numbers less than 100 are considered developmental.

### **ACCOUNTING**

**ACC 103 Accounting Principles I.** Fundamentals of accounting and their application to a sole proprietorship and partnership. 3 credit hours.

**ACC 104 Accounting Principles II.** This course teaches the fundamental principles of accounting for partnerships and corporations as well as managerial accounting principles and techniques. Prerequisite: ACC 103 with a grade of “C” or better. 3 credit hours.

**ACC 110 Automated Accounting and Payroll.** Students develop an understanding of the personnel and payroll records that provide the information required by the numerous laws affecting the operation of the payroll system. Prerequisite: ACC 103. 3 credit hours.

**ACC 204 Managerial Accounting.** This course introduces students to information needed by managers to carry out the essential functions in an organization: planning, operations, controlling activities, and making decisions. Corequisite: ACC 104. 3 credit hours.

**ACC 208 Intermediate Accounting I.** Preparation of financial statements for a business entity. Organization, interpretation, classification and determination of content and values of accounts. This course is a combination of lecture and lab. Prerequisite: ACC 104. 3 credit hours.

**ACC 212 Income Tax.** Principles and procedures required by current laws and regulations relating to federal income taxes and social security taxes with practical applications emphasized. This course is a combination of lecture and lab. 3 credit hours.

**ACC 268 Auditing.** Includes underlying principles of verification, analysis, and interpretation of accounting records and statements with emphasis on collection and evaluation of audit evidence and preparation of audit reports. Prerequisite: ACC 104. 3 credit hours.



## COMMUNICATION

**BUS 125 Job Search Strategies.** This course is designed to help a student plan and organize a job search, compose job search documents, and demonstrate job-ready behaviors. Topics include resumes, cover letters, references, job applications, interviews, and follow-up letters. 1 credit hour.

**COM 030 Introductory English as a Second Language.** Basic English language for daily life in an American college; industry-related vocabulary, reading comprehension and pronunciation; giving directions and checking comprehension of instructions; present, past and future tenses, and modal verbs. 3 credit hours.

**COM 035 Intermediate English as a Second Language.** Communicating detailed stories of the past or plans for the future; perfect and continuous tenses; colloquial expressions and phrasal verbs. 2 credit hours.

**COM 050 Reading Fundamentals.** This course is for students who need to develop their reading skills. Emphasis will be on phonics, vocabulary development, reading comprehension, and fluency. Prerequisite: Appropriate placement score. 3 credit hours.

**COM 070 Reading Improvement.** This course is for students who need to develop their reading skills for college and/or work. To improve reading comprehension, emphasis will be placed on the identification of main ideas, relevant details, and organizational patterns. Vocabulary development and reading rate will also be addressed. Prerequisite: Appropriate placement score or COM 050 with a grade of "C" or better. 3 credit hours.

**COM 096 Introduction to Writing.** A developmental writing course for students who need to improve or brush up on writing skills before attempting college-level composition. The course is designed to improve student skills in basic grammar, usage, punctuation, and sentence and paragraph structure. This course is not intended for transfer and does not count toward graduation. Students must achieve a "C" or better to advance to COM 101. Prerequisite: A locally administered writing placement test or satisfactory scores on the ACT, COMPASS or ASSET writing tests will be used to place students in this course. 5 credit hours.

**\*\*COM 101 English Composition.** Students learn the writing process, including prewriting, drafting, revising, proofreading, and editing. Students learn to distinguish between fact and opinion, to support opinions with facts, and to organize ideas in a logical manner. Students write a variety of assignments that include the rhetorical modes. Basic components of research are also included. Prerequisite: Satisfactory scores on ACT, ASSET, COMPASS, or local writing tests, or a grade of "C" or better in COM 096. 3 credit hours.

**COM 102 English Composition II: Writing the Research Paper.** This course is a continuation of composition stressing writing as a process designed to teach students to find and use library and online resources, to analyze reading materials, to organize and present information accurately, and to cite research sources correctly. A research paper and several shorter writings are required. Prerequisite: COM 101. 3 credit hours.

**\*\*COM 110 Honors Composition.** This course is open only to those students who demonstrate above average ability on a department-approved placement test. The course is designed to offer a more challenging and rewarding experience for such students. Emphasis in the course is on development of ideas through the use of rhetorical patterns. Students will read widely and intensively and write a research paper. Prerequisite: Above average scores on a department-approved placement test. 3 credit hours.

**\*\*COM 111 Oral Communications.** A study and practice of interpersonal and group communication skills focusing upon the development and improvement of communication. Topics include verbal and nonverbal techniques, listening skills, professional presentations, conflict resolution, and group dynamics. 3 credit hours.

**\*\*COM 121 Public Speaking.** This course is designed to prepare the student to give speeches and oral presentations. Course will include audience analysis, speech content and preparation, and speech delivery. This course may be substituted for COM 111. 3 credit hours.



**COM 130 Fundamentals of Effective Reading.** This course helps students improve their reading skills for specific technical career development. Students will practice strategies for effectively reading a variety of texts related to a technical career. Active and critical reading skills will be included. 2 credit hours.

**COM 134 Effective and Critical Reading.** This course helps students develop their reading skills as a resource for career development and lifelong learning. Methods for effectively reading a variety of challenging materials such as technical manuals and textbooks will be practiced. Active and critical reading skills will be included. 3 credit hours.

**COM 190 Writing for the World Wide Web.** Writing for the World Wide Web is an introduction to the Web through rhetorical study and practical experience. This course offers an introduction and application of web design, writing, and analysis of web-based publications. Prerequisites: CPP 101 and COM 101 or COM 110. 3 credit hours.

**COM 201 Occupational Communication.** The purpose of this course is to teach the student to write a variety of business documents in an effective and appropriate style. In addition, students will prepare and deliver oral presentations relating to the work place. Prerequisite: COM 101 or COM 110 with a grade of "C" or better. 3 credit hours.

**COM 211 Technical Writing.** This course covers the organization and writing of technical documents including proposals, memos, letters, reports, instructions, and electronic communications. Other topics include audience analysis, multiculturalism, graphics, and page design, and ethical and legal considerations. Prerequisite: COM 101 or COM 110 with a grade of "C" or better. 3 credit hours.

**COM 290 Introduction to Theatre.** This course offers an introduction to the theatrical concerns of acting, voice, and movement. Topics will include listening, improvisation, dramatic reading, monologues, and duet acting. The course will also introduce basic terminology, how to audition, script analysis, and stage set up. Field trips to attend various theatrical performances will also be included. Prerequisite: COM 111 or COM 121 with a grade of "C" or better. 3 credit hours.

**COM 292 Introduction to Theatre II.** This course continues the study begun in COM 290 and offers an introduction to the theatrical concerns of acting, voice, and movement. Topics will include listening, improvisation, dramatic reading, monologues, and duet acting. Field trips to attend various theatrical performances will also be included. Prerequisite: COM 290. 3 credit hours.

**COM 299 Special Topics in Communications.** Special Topics in Communications (COM) is open to students who have reached advanced standing but wish to continue further study and practice in communications. Projects may be undertaken in any area related to communications or a combination of communications and the student's major with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.

\*\* This course meets the oral and written communication general education requirement.

## **ENGINEERING/MATHEMATICS/SCIENCE**

**EMS 101 Statistical Process Control.** An introduction to measurement principals and data collection, statistical measures of central tendency and dispersion, properties of the normal frequency distribution, application of sampling statistics to X-bar and R charts, and computation and display of process capability indices. 1 credit hour.



**EMS 110 Mathematics for Metalworking.** A study of the material which enables the student to gain an intensive, practical, working knowledge of arithmetic, algebra, geometry, and trigonometry. This class will include challenges of solving comprehensive problems relevant to precision custom manufacturing that are similar to what will be encountered in the work environment. 3 credit hours.

**EMS 120 Trigonometry for Industrial Electricity.** Topics covered include solution of right and oblique triangle trigonometry; sinusoidal curves; alternating current and phase angles; complex numbers and phasors; and applications to series, parallel and series-parallel AC circuits. Prerequisite: Satisfactory placement score or MAT 050 or MAT 053 with a grade of "C" or better or SPM 050 with a passing grade. 3 credit hours.

**EMS 246 Statics.** Selected topics from trigonometry, force vectors, components, moments of forces, equilibrium, and parallel force systems, concurrent and non-concurrent force systems both coplanar and non-coplanar are covered. Stress in trusses by method of joints, sections, and pins will be analyzed. Friction is also investigated. Corequisite: MAT 121 or Prerequisite: CCT 106. 5 credit hours.

**EMS 247 Strength of Materials.** Topics covered include calculation of stress and deformation caused by tension, compression, shear, temperature, torsion, bending and buckling loads. Results of these calculations are used to select appropriate structural members to support designated loads, analyze nonstandard beams, and design steel reinforced concrete slabs. Prerequisite: EMS 246. 5 credit hours.

## **ENTREPRENEURSHIP**

**ENT 100 Essentials of Entrepreneurship.** This course provides an overview of entrepreneurship and the resources available to those considering small business opportunities. Students will be introduced to the essentials of starting a small business. 3 credit hours.

## **MATHEMATICS**

**MAT 030 Preparatory Mathematics.** This course includes the following topics of study: operations with decimal and fractional numbers, percents, ratio and proportions, areas and volumes, English and Metric units and measuring devices, introduction to signed numbers, and operations with linear algebra equations. Prerequisite: Satisfactory placement score. 3 credit hours.

**MAT 050 Introductory Algebra.** This course includes the following topics of study: the real number system, solving linear equations and inequalities, graphing linear functions, systems of linear equations, exponents and polynomials, and an introduction to factoring. Prerequisite: Satisfactory placement score or MAT 030 or HEO 112 with a grade of "C" or better or SPM 030 with a passing grade. 3 credit hours.

**MAT 053 Accelerated Introductory Algebra.** This course includes the following topics of study: the real number system, solving linear equations and inequalities, graphing linear functions, systems of linear equations, exponents and polynomials, and factoring polynomials. Prerequisite: Satisfactory placement score or MAT 030 with a grade of "C" or better or SPM 030 with a passing grade. 3 credit hours.

**MAT 070 Intermediate Algebra.** This course includes the following topics of study: factoring polynomials, rational and radical expressions and equations, basic functions and their graphs, and quadratic equations. Prerequisite: Satisfactory placement score or MAT 050 or MAT 053 with a grade of "C" or better or SPM 050 with a passing grade. 3 credit hours.

**MAT 073 Intermediate Algebra with Trigonometry.** This course includes the following topics of study: rational and radical expressions and equations, basic algebraic and trigonometric functions and their graphs, quadratic equations, and right triangle trigonometry. Prerequisite: Satisfactory placement score or MAT 053 with a grade of "C" or better. 3 credit hours.



**MAT 111 Trigonometry.** This course includes angle-based trigonometric functions and their inverses, multiple angle formulas, identities, trigonometric equations, radian measure, arc length, angular velocity, graphs of trigonometric functions, and solutions of right triangles. This course is intended for use at off-campus locations only. Prerequisite: MAT 070 or MAT 073 or SPM 070. 2 credit hours.

**\*\*MAT 115 College Algebra.** This college algebra course includes a basic review of exponents, radical expressions, rational exponents, polynomial expressions, factoring, and rational expressions. Students will solve linear, absolute value, quadratic, polynomial, radical, rational, exponential and logarithmic equations; and systems of equations, along with applications. The course covers graphs of circles and functions including linear, quadratic, piecewise, polynomial, rational, exponential and logarithmic. Prerequisite: Satisfactory placement score or MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. 3 credit hours.

**\*\*MAT 116 College Algebra Using Mathematical Modeling.** Study of properties and graphs of linear, quadratic, polynomial, exponential, radical, and logarithmic functions with applications. May be substituted for MAT 115. Prerequisite: Satisfactory placement score or MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. 3 credit hours.

**\*\*MAT 118 Survey of College Mathematics.** College mathematics including the following topics: algebra, geometry, trigonometry, counting methods, probability, statistics, consumer finance, and logic. Prerequisite: Satisfactory placement score or MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. 3 credit hours.

**\*\*MAT 120 Pre-Calculus.** Selected topics in algebra and trigonometry to prepare the student for calculus. Topics covered will include algebraic, exponential, logarithmic, and trigonometric functions, the graphs of these functions, the solution of right and oblique triangles, trigonometric identities, and the solution of trigonometric equations. Prerequisite: Satisfactory placement score or MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. 5 credit hours.

**MAT 121 Trigonometry.** Topics covered include graphing of the trigonometric functions and their use in solution of right and oblique triangles, identities, and solution of trigonometric equations in rectangular and polar coordinates. Corequisite: MAT 073 or MAT 070 or SPM 070. 3 credit hours.

**\*\*MAT 122 Elements of Calculus.** An introduction to the concepts and methods of differential and integral calculus. Topics covered will include limits and rates of change, derivatives of polynomial, exponential, logarithmic and trigonometric functions, integrals, and applications. Prerequisites: MAT 120 or both MAT 115 and MAT 121 or MAT 111 with a grade of “C” or better. 3 credit hours.

**\*\*MAT 123 Calculus I.** Topics covered include functions, limits and rates of change, derivatives, the mean value theorem and curve sketching, logarithmic and exponential functions, integrals and applications. Prerequisite: MAT 115 or MAT 116 or MAT 120 with a grade of “C” or better. 5 credit hours.

**SPM 030 Self-paced Preparatory Mathematics.** This is an internet based, self-paced tutorial in basic mathematics. Topics studied will include operations with decimal and fractional numbers, percents, ratio and proportions, areas and volumes, English and Metric units and measuring devices, introduction to signed numbers, and operations with linear algebra equations. The SPM series of courses satisfy prerequisite requirements for subsequent courses but are not for credit, and no grade will appear on the transcript. The student must make arrangements in advance with the Math Department to take the MAT 030 final exam on campus. The final exam is taken on a pass/fail basis and 70% or higher is the minimum passing score. Prerequisite: Satisfactory placement score. No credit.



**SPM 050 Self-paced Introductory Algebra.** This is an internet-based, self-paced tutorial in Introductory Algebra including the study of the real number system, solving linear equations and inequalities, systems of equations, graphing, formula rearrangement, exponents and polynomials, and factoring. The SPM series of courses satisfy prerequisite requirements for subsequent courses but are not for credit, and no grade will appear on the transcript. The student must make arrangements in advance with the Math Department to take the MAT 050 final exam on campus. The final exam is taken on a pass/fail basis and 70% or higher is the minimum passing score. Prerequisite: Satisfactory placement score or MAT 030 with a grade of “C” or better or SPM 030 with a passing grade. No credit.

**SPM 070 Self-paced Intermediate Algebra.** This is an internet-based, self-paced tutorial in Intermediate Algebra including the review of factoring polynomials, rational expressions, radicals, quadratic equations, and linear systems. The SPM series of courses satisfy prerequisite requirements for subsequent courses but are not for credit, and no grade will appear on the transcript. The student must make arrangements in advance with the Math Department to take the MAT 070 final exam on campus. The final exam is taken on a pass/fail basis and 70% or higher is the minimum passing score. Prerequisite: Satisfactory placement score or MAT 050 with a grade of “C” or better or SPM 050 with a passing grade. No credit.

\*\* This course meets the mathematics general education requirement.

## **MILITARY SCIENCE**

**MSC 101 Military Science Course I.** This course is part one in the foundation for the Reserve Officer's Training Corps course. During each class session students will be instructed in basic military skills/civilian leadership skills. In addition to classes, there will be various on and off campus field training exercises and physical training sessions. Each class is fifty minutes in length. Registration in this course does not mean the student has enlisted in the military. The student is under no military obligation at this time. 1 credit hour.

**MSC 102 Military Science Course II.** This course is part two in the foundation for the Reserve Officer's Training Corps course. During each class session students will be instructed in basic military skills/civilian leadership skills. In addition to classes, there will be various on and off campus field training exercises and physical training sessions. Each class is fifty minutes in length. Registration in this course does not mean the student has enlisted in the military. The student is under no military obligation at this time. 1 credit hour.

**MSC 201 Military Science Course III.** This course is part one in the training/development process of the Reserve Officer's Training Corps. This course is designed to enhance basic military skills and carefully evaluate the student's leadership potential for becoming a commissioned officer if he/she so desires. During the course, students who possess the potential and exhibit the positive desire to continue in the program have the opportunity to apply for various ROTC scholarships and become an ROTC cadet in the Advanced Course as a junior or senior classman. 2 credit hours.

**MSC 202 Military Science Course IV.** This course is part two in the training/development process of the Reserve Officer Training Corps. The course is designed to enhance basic military skills and carefully evaluate the student's leadership potential for becoming a commissioned officer if he/she so desires. During the course, students who possess the potential and exhibit the positive desire to continue in the program have the opportunity to apply for various ROTC scholarships and become an ROTC cadet in the Advanced Course as a junior and senior classman. 2 credit hours.

## SCIENCE

**ASC 104 Human Anatomy and Physiology w/Lab I.** This course covers orientation to the human body; basic chemistry with respect to human body functions; overview of human cell anatomy and function; body tissues; and the integumentary, skeletal, muscular, and nervous systems. This course explores the relationship between these systems. This course is intended to be taught at the Jefferson City campus. 4 credit hours.

**ASC 106 Human Anatomy and Physiology w/Lab II.** This course builds on topics taught in the first semester and provides a comprehensive look at the regulation and integration of the human body with emphasis on the endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems. This course also explores the relationship between these systems. This course is intended to be taught at the Jefferson City campus. Prerequisite: ASC 104 with a grade of “C” or better. 4 credit hours.

**ASC 110 Medical Terminology.** This comprehensive introduction to medical terminology is organized by body system and specialty areas of practice. Word building rules assist in understanding the basis for combining word elements and medical terms are broken down into component parts each time a new term is introduced. This course is designed to help the student acquire a working medical vocabulary to spell, use and define medical terms. 1 credit hour.

**\*\*PHY 100 Physical Science.** This lecture-demonstration-laboratory survey of the physical sciences is designed for the student with a limited science background. Students should learn about the scientific method and its application with special emphasis on scientific principles encountered in our everyday interactions with our environment. This course is intended for off-campus locations. Prerequisite: MAT 050 with a grade of “C” or better or SPM 050 with a passing grade. 4 credit hours.

**\*\*PHY 101 College Physics.** This algebra based physics course has topics that may include, but are not limited to, measurement, force, work and energy, matter, fluids, gasses, heat, light, and selected topics in modern physics. Prerequisite: MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. Concurrent: PHY 102. 4 credit hours.

**\*\*PHY 102 College Physics Lab.** This algebra based physics lab course has topics that may include, but are not limited to, measurement, force, work and energy, matter, fluids, gasses, heat, light, and selected topics in modern physics. Prerequisite: MAT 070 or MAT 073 with a grade of “C” or better or SPM 070 with a passing grade. Concurrent: PHY 101. 0 credit hours – all credit given in PHY 101.

**\*\*PHY 103 Environmental Science.** Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. Information about physical, chemical, and biological conditions of the environment and their effect on organisms are studied to help solve ecological problems. Sustainable natural resource management will be stressed. An attitude of stewardship of natural capital will be encouraged. Prerequisites: COM 101 or COM 110 and CPP 101 or CPP 102. Concurrent: PHY 104. 4 credit hours.

**\*\*PHY 104 Environmental Science Lab.** This is the science lab corresponding to Environmental Science (PHY 103). It will consist of the study of environmental problems and possible alternative solutions to those problems. Both qualitative and quantitative measurements involving man and his relationship to issues such as the environment, energy, land use, water and air pollution will be taken. Prerequisites: COM 101 or COM 110 and CPP 101 or CPP 102. Concurrent: PHY 103. 0 credit hours – all credit given in PHY 103.

**\*\*PHY 201 General Physics.** This calculus based traditional physics course with lab includes, but is not limited to, selected topics from classical mechanics with other material included as time permits. Prerequisite: MAT 122 or MAT 123 with a grade of “C” or better. 5 credit hours.

**\*\*** This course meets the science general education requirement.



## SEMINAR

**SEM 110 Spanish Language and Hispanic Culture.** This is a two day seminar offered for students and professionals for the purpose of learning conversational Spanish and Spanish culture. Participants have a desire to better understand and communicate with crew and co-workers of Spanish origin working in their industry. No credit.

**SEM 135 Ford Maintenance & Light Repair (MLR) Service Training Seminar.** The MLR service training seminar is an internet based series of courses designed by Ford Motor Company for entry level technicians at Ford Dealerships and for NATEF approved training programs like the college's Automotive Technology Program. The seminar allows students to gain Ford Motor Company recognized certification before entering the job market. Prerequisite: Classroom instruction in the ASE mechanical area and instructor's permission. No credit.

## SOCIAL SCIENCE

**\*\*HST 105 American History to 1877.** This course surveys political, cultural, economic, and social development of the United States from 15<sup>th</sup> century European exploration through reconstruction. Course readings, discussions, and tests comply with state requirements regarding the Missouri and federal constitutions. 3 credit hours.

**\*\*HST 110 American History from 1877 to the Present.** History of America from the Civil War to the present. This course will allow students to discuss and explain different events in American History. They will learn to recognize names and events that have consequences in their lives today. A service learning project will be incorporated into this course in which the students will be required to complete a community service activity within a historical sphere. Course readings, discussions, and tests comply with state requirements regarding the Missouri and federal constitutions. 3 credit hours.

**HST 299 Special Topics in History.** Special Topics in History (HST) is open to students who have reached advanced standing but wish to continue further study on historical topics. Study may be undertaken in any area related to history or a combination of history and the student's major with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.

**PSC 100 Missouri Government and Constitution.** This course covers the Missouri constitution and state government structure. It is the approved method for students transferring in an American Government or American History course that does not meet the Missouri constitution requirement to meet that requirement. Prerequisite: American Government or American History course completed, passed with a grade of "C" or better, and transferred to LSTC. 1 credit hour.

**\*\*PSC 101 American Government.** This course is a survey of American political institutions on the national, state, and local levels. It deals with the basic philosophical foundations of these institutions, their organization, and function. Course readings, discussions, and tests comply with state requirements regarding the Missouri and federal constitutions. 3 credit hours.

**PSY 161 Health Psychology.** This course explores the basic principles of human behavior. The student focuses on effective interactions that help the health care provider to provide personalized care to the patient and to eliminate negative or ineffective habits. An introduction into death and dying examines the process of dying, the grief process and the dying process as an opportunity for growth. Stress management is addressed and related to the experiences as a student and neophyte health care provider. The mind-body connection is examined, as well as ethical issues related to the health care provided. 3 credit hours.

**\*\*** This course meets the social science general education requirement.



## TECHNICAL FOUNDATION

**MPT 151 Shop Skills.** Advanced principles and fundamentals of SMAW, Oxy-fuel welding, cutting, and brazing, GTAW, GMAW and tool sharpening as applied to auto body and frame repairs. Prerequisite: MPT 165. 3 credit hours.

**MPT 165 Basic Welding.** Basic principles and fundamentals of SMAW, Oxy-fuel (welding, cutting and brazing), GTAW and GMAW. 3 credit hours.

**MPT 225 Welding and Fabrication for High Performance Vehicles.** This course teaches welding and fabrication for high performance motorsports. It includes bending, notching, and designing roll cages and frames using mild steel tubing, chrome-moly tubing, and aluminum. The welding processes used are GTAW and GMAW. Corequisite: MPT 165 with a grade of "C" or better. 2 credit hours.

**WLD 120 CAT Welding.** This course is designed to acquaint the student with more common welding techniques and equipment used currently in trades and industry. Consideration is given to welding with arc and oxyacetylene in various positions, hard surfacing, brazing, cutting, electrode selection and metal identification. The student is expected to develop basic skills in general welding. 2 credit hours.

## TECHNICAL LITERACY

**\*\*CPP 101 Introduction to Microcomputer Usage.** An introductory course in the fundamentals of using computer applications. 3 credit hours.

**\*\*CPP 102 Advanced Microcomputer Usage.** This course emphasizes advanced features of word processing, database, spreadsheet and presentation software as well as a review of the operating system. The focus is on comprehensive projects which include using advanced word processing features; developing database design and management skills; creating spreadsheet models and macros; designing and creating multi-media presentations and creating advanced projects which integrate computer applications. 3 credit hours.

**\*\*** This course meets the technical literacy general education requirement.



The Association of Technology,  
Management, and Applied Engineering

## **AUTOMATION & ROBOTICS TECHNOLOGY**

**15.0613**

*(Associate of Applied Science Degree)*

The Automation & Robotics Technology program offers a world-class education in a field that blends high-tech electronics with state-of-the-art mechanical and computer systems. In many industries today, and definitely in the future, electro-mechanical integration is and will be the main component of mass production. Skilled technicians will be needed to create, install and maintain these automated systems. The Automation & Robotics Technology program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The program prepares students for the work environment with course work focused on design and fabrication of individual piece-parts and flexible machining systems (FMS). This type of automation incorporates computer numerical control (CNC) machining centers, programmable robots, electronically controlled part handling/transfer systems and vision quality control monitoring instruments. This program is designed to provide a broad industrial and technological background for the student to pursue careers as entry-level CNC operators/programmers, electrical maintenance technicians, electronics technicians, machinists, or specialized automation technicians.

An optional eight-week internship is included in the summer semester between the first and second years. The student will perform outlined duties pertaining to their specific program of study.

This program is offered only in Mexico, Missouri, at the Advanced Technology Center.

### **Program Mission**

The Automation & Robotics Technology program provides students with the technical and interpersonal skills and knowledge that qualify them to work as a technician in today's automated manufacturing industries.

### **Program Goals**

The goals of the program are to assure that the student has the opportunity to:

- Develop effective oral and written communication skills.
- Develop knowledge and skills necessary to program, set-up, and operate manual and CNC machine tools.
- Develop an analytic approach to problem solving and troubleshooting.
- Demonstrate professional and safety minded practices required by industry standards.
- Demonstrate technical competency in managing and sustaining automated robotic manufacturing cells.

### **CORE CURRICULUM**

			<b>Credit Hours</b>
MAR	101	Introduction to Electricity	4
MAR	110	Mechanical and Fluid Power Transmission	3
MAR	118	Industrial Motors and their Controls	4
MAR	125	Applied Electronics	4
MAR	150	Machine Shop Fundamentals	4
MAR	175	Machine Tool Programming	4
MAR	204	PLC Programming	4



MAR	206	Industrial Robotics	4
MAR	208	Computer Aided Machining	4
MAR	211	Theory of Industrial Automation	2
MAR	215	Introduction to Quality Control	3
MAR	218	Computer Interfacing	3
MAR	221	Mechanical and Electronic Device Troubleshooting	3
MAR	231	CIM Applications	4
<b>Optional:</b>			
MAR	190	Internship I (Optional)	(4)
<b>SUB-TOTAL</b>			<b>50-54</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>			
General Education Requirements (see page 44)			19
Must Include: PHY 101/102 College Physics			4
<b>SUB-TOTAL</b>			<b>19</b>
<b>GRADUATION REQUIREMENT</b>			
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>
<b>PROGRAM TOTAL</b>			<b>70-74</b>

The following Machining Specialist and Electrical Specialist less than one-year certificate options have been designed for part-time students. The courses listed in these two less than one-year certificates will be offered in the same sequence and semester they are being taught for the full-time Automation & Robotics Technology program.

**MACHINING SPECIALIST**

**15.0613**

*(Less than One-Year Certificate)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
MAR	150	Machine Shop Fundamentals	4
MAR	175	Machine Tool Programming	4
MAR	191	Machine Tool Operations	4
MAR	208	Computer Aided Machining	4
MAR	215	Introduction to Quality Control	3
<b>SUB-TOTAL</b>			<b>19</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>			
CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
<b>SUB-TOTAL</b>			<b>6</b>



		<b>GRADUATION REQUIREMENT</b>	
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		<b>PROGRAM TOTAL</b>	<b>26</b>

**ELECTRICAL SPECIALIST**  
**15.0613**  
*(Less than One-Year Certificate)*

		<b>CORE CURRICULUM</b>	<b>Credit Hours</b>
MAR	101	Introduction to Electricity	4
MAR	118	Industrial Motors and their Controls	4
MAR	125	Applied Electronics	4
MAR	204	PLC Programming	4
MAR	218	Computer Interfacing	3
		<b>SUB-TOTAL</b>	<b>19</b>

		<b>GENERAL EDUCATION REQUIREMENTS</b>	
CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
		<b>SUB-TOTAL</b>	<b>6</b>

		<b>GRADUATION REQUIREMENT</b>	
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		<b>PROGRAM TOTAL</b>	<b>26</b>

**MAR 101 Introduction to Electricity.** This course introduces and develops the concepts necessary for understanding the use of electrical components and circuitry. Technical math including scientific notation, significant figures, unit conversions, beginning algebra and basic trigonometry will be introduced and developed throughout the course. The first half of the semester is devoted to DC, the second to AC. Prerequisite: A "C" or higher in MAT 030 or satisfactory placement score into MAT 050 or higher. 4 credit hours.

**MAR 103 Introduction to Photonics.** This course covers the fundamentals of photonics and optics, the history of the photonics industry, and an introduction to lasers and laser applications. Photonics/laser safety and practices are discussed, emphasized and practiced. Corequisite: MAR 101. 3 credit hours.



**MAR 105** Data Collection, Analysis and Reporting. This course is designed to introduce students to crafting technical reports by using data analysis methods, similar to those required in industry. This course is writing intensive and spreadsheet intensive, and will concentrate on correct writing style as well as clear and concise presentation of data and graphs. 1 credit hour.

**MAR 110** Mechanical and Fluid Power Transmission. This course includes mechanical power transmission topics such as brakes, clutches, gears, couplings, shafts, chains and sprockets, cams and bearings. Hydraulic items include liquid properties, cylinders, motors, pumps, valves and math for proper sizing of components. Pneumatic items include physical principles, cylinders, motors, compressors and control valves. Simulation of circuits will be performed before any laboratory work is done. Laboratory exercises are provided to enhance classroom topics. 3 credit hours.

**MAR 118** Industrial Motors and their Controls. This course introduces the students to various types of industrial motors and controls. The student will identify, select, install/wire and troubleshoot three phase and single phase DC/AC motors and controls, including servo and stepper motors. Laboratory exercises include designing and building control modules for machine integration. Prerequisite: MAR 101. 4 credit hours.

**MAR 121** Geometric Optics. This course is designed to teach the student the theory of light as a geometric ray. The laws of reflection and refraction from mathematical, graphical and experimental aspects are studied. Computers are used as an aid for graphical and computational requirements. Prerequisite: MAR 103. 2 credit hours.

**MAR 123** Wave Optics. This course covers the theory of light as a wave, the units used to measure light and polarization. Interference, holography and other areas that affect light as it propagates through different media are studied. Prerequisite: MAR 121. 2 credit hours.

**MAR 125** Applied Electronics. This course introduces and develops the concepts necessary to analyze and test both discrete and integrated circuit components. The first half of the semester is devoted to Analog Circuits, the second to Digital Electronic. Also includes a laboratory course with experiments designed to support this course theory. Prerequisite: MAR 101. 4 credit hours.

**MAR 150** Machine Shop Fundamentals. This course introduces the student to mechanical blueprint reading, shop safety, bench work and layout, hand tools, measuring instruments and manual machine tools. Technical math including fractions, unit conversions, and basic trigonometry will be introduced and developed throughout the course. Emphasis is placed on the sequence of machining piece parts, tool selection and machine set-up and operation. Prerequisite: A "C" or higher in MAT 030 or SPM 030 with a passing grade or satisfactory placement score into MAT 050 or higher. 4 credit hours.

**MAR 175** Machine Tool Programming. This course is designed to give the student a complete overview on "how to" operate and program computer based industrial machining centers. Emphasis is placed on lathe and mill programming techniques and structures, CNC controller types and overall machine operation. Other topics discussed: machine set-up and tooling, part set-up and inspection and MDI programming. Prerequisite: MAR 150. 4 credit hours.

**MAR 190** Internship I. The internship is comprised of 320 hours of work experience in a manufacturing or laser applications setting requiring the student to perform a variety of tasks. The student is expected to apply learned skills to be a productive employee, and the employer is expected to provide an environment that enhances the student's exposure to the industry. Prerequisite: Department Chair approval. 4 credit hours.

**MAR 191** Machine Tool Operations. This course is a continuation of MAR 150 and is designed to give the student more "hands-on" machining time. Basic manual machine tools, such as the lathe and mill, will be used to fabricate numerous basic and intermediate projects to specific dimensions and tolerances. Machining Certificate Only. Prerequisite: MAR 150. 4 credit hours.



**MAR 202 Laser System Design.** Students will study solid state, semiconductor, atomic gas and molecular lasers in detail, including power supply circuits for each different type. Laser system accessories, including acousto-, electro- and magneto-optic components will be covered and utilized in a laboratory setting. Students will also be required to build a laser cavity and optimize the output power of that system utilizing information obtained in lecture. Prerequisites: MAR 123, MAR 125, MAR 175, and MAT 115. 4 credit hours.

**MAR 204 PLC Programming.** This course includes a review of number systems, Programmable Logic Control addressing, use of software, system control and an in depth study of ladder logic programming. Programming topics include: discrete and analog inputs and outputs, internal registers and tables, editing, timers, counters, comparison functions, computational functions, data move functions, subroutines, data manipulation and sequencing functions, high speed counting, trigonometric and advanced math functions. Laboratory exercises are provided to enhance classroom topics. Prerequisites: MAR 118 and MAR 125. 4 credit hours.

**MAR 205 Photonics Applications.** This course provides exposure to the various industrial, medical and military laser applications and includes the use of fiber optics in telecommunications. Students will work in a team environment to conduct experiments that demonstrate the various applications for photonics. Prerequisites: MAR 123 and MAR 125. Corequisite: MAT 115. 3 credit hours.

**MAR 206 Industrial Robotics.** The course is an introduction to state-of-the-art industrial robotics. The course is focused on installation, repair and maintenance of robots and robotic manufacturing systems. Robotic mechanisms and sensors will be reviewed along with interfacing and programming of the controls to perform intermediate manufacturing tasks. Corequisite: MAR 204. 4 credit hours.

**MAR 208 Computer Aided Machining.** This course introduces the student, through hands-on experience, the basics of CAD (Computer Aided Drafting) and CAM (Computer Aided Machining). The student will design numerous projects, generate machine tool programs, DNC interface with CNC machine tools and fabricate their designs to reality. Prerequisite: MAR 175. 4 credit hours.

**MAR 210 Materials Processing with Lasers.** This course studies the various materials that can be processed by a laser beam. The students will work in teams to study and demonstrate the effects that a laser beam has on the respective material. Prerequisites: MAR 123 and MAR 125. Corequisite: MAT 115. 3 credit hours.

**MAR 211 Theory of Industrial Automation.** This course includes a definition of Computer Integrated Manufacturing (CIM) and provides a foundation for its application. Concepts covered include manufacturing product planning, production engineering, production planning, control, and execution. A definition of flexible manufacturing gives the student an insight into the factory of the future. Current employment trends will be discussed. Each student will be prepared to seek employment. This course will be oriented toward choosing, planning for, and conducting the final project on the CIM cell. Project Management software will be taught and utilized. Prerequisite: Department Chair approval. 2 credit hours.

**MAR 215 Introduction to Quality Control.** This course serves as an introduction to quality for students who are pursuing careers in manufacturing technology or related technical fields. Topics include fundamentals of statistics, control chart variables and attributes, reliability, quality costs, sampling plans, and probability. Prerequisite: MAR 150. 3 credit hours.

**MAR 218 Computer Interfacing.** This course introduces the use of personal computers for data and control in an industrial environment. Applications using common personal computers, "off-the-shelf" components and interfacing boards will be discussed. Also includes a laboratory course with experiments designed to support computer interfacing. Prerequisite: MAR 118. 3 credit hours.

**MAR 220 Laser System Troubleshooting.** This course is designed to provide a comprehensive knowledge of the methods used to troubleshoot and repair problems that occur with laser equipment and its operation. Hands on experience is emphasized. Skill using tools and measurement equipment is developed. Prerequisites: MAR 202 and MAR 210. 3 credit hours.



**MAR 221 Mechanical and Electronic Device Troubleshooting.** This course will emphasize the troubleshooting, repair, and maintenance of automation devices such as robots, CNC machining centers, positioning tables, and PLC control systems. Students will be instructed on factory recommended procedures and will be expected to apply proper procedures to different types of industrial equipment. Prerequisites: MAR 118, MAR 204, MAR 206, and MAR 208. 3 credit hours.

**MAR 231 CIM Applications.** This course is project oriented. The students are required to design a project to be manufactured in the laboratory CIM cell. The student will program the robots at each workstation, program the PLCs, establish the production plan and routing, design and make the necessary tooling and program the CNC machines to manufacture the product. The students will wire the components necessary to run the cell. Teamwork will be emphasized. The students will be expected to utilize all previous courses to accomplish the production of the project. The students will compose a written report of the final project. Prerequisite: MAR 211. 4 credit hours.

**MAR 299 Special Topics in Automation & Robotics Technology.** Special Topics in Automation & Robotics Technology (MAR) may include instruction on topics not covered in other MAR courses. Topics covered in other MAR courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. Prerequisite: Department Chair approval. 1-4 credit hours.



The Association of Technology,  
Management, and Applied Engineering

## **AUTOMOTIVE COLLISION TECHNOLOGY**

**47.0603**

*(Associate of Applied Science Degree)*

The Automotive Collision Technology program of Linn State Technical College prepares students to take advantage of the opportunities in many related areas which include auto body repair, auto body painting, auto body estimating (shop supervisor) and collision damage estimating (insurance). The Automotive Collision Technology program is certified by the National Automotive Technicians Education Foundation's (NATEF)/Automotive Service Excellence (ASE). The program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

Enrollment in the Automotive Collision Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

Students may complete a two-year Associate of Applied Science degree program or students may choose to pursue a one-year technical certificate in the area of Refinishing & Non-Structural Repair or Structural & Mechanical Repair. The student gets intensive hands-on experience in repairing a variety of damaged vehicles. The auto body shop is well equipped with an extensive inventory of power tools and accessories such as the following:

Kansas Jack Frame Equipment	Car-O-Liner Computerized Measuring System
Chief Velocity Computerized Measuring System	Pro Spot Squeeze Type Resistance Spot Welder
Sanders	MIG Welders
Hydraulic Power Tools	Centerline Gauge System
Grinders	USI ITALIA Paint Booths
Air Tools	Prep Station
DUZ-MOR Frame Rack	Paint Mixing System
Paint Guns & Equipment	Waterborne Paint Technology
Car-O-Liner Bench Frame Rack	

The Automotive Collision Technology program contributes to the green economy by teaching students to repair vehicles that may otherwise be discarded. The program uses waterborne paint technology to reduce the program's carbon footprint. Most parts used in the program are used or recycled assemblies. Solvents and other chemicals are recycled to help reduce water, air, and soil contamination.

Courses in electrical systems, shop metal and shop management ensure that the student can advance and specialize in the field after gaining employment.

Students who graduate with an Associate of Applied Science degree in Automotive Technology may pursue a second Associate of Applied Science degree in Automotive Collision Technology.

It is a graduation requirement of the Automotive Collision Technology (ACT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.



**Program Mission**

The mission of the Automotive Collision Technology program is to prepare students with the higher education, technical, and interpersonal skills needed for employment in the challenging and highly technical career of Automotive Collision Technology, with the foundation for Automotive Service Excellence (ASE) Master Technician Certification.

**Program Goals**

The goals of the program are to provide the opportunity for students to develop:

- Electrical knowledge and skills needed to repair and maintain safety devices related to automotive industry.
- Knowledge and skills necessary to repair, replace and estimate structural and non-structural damages.
- Knowledge and skills necessary in replacing and estimating of non-structural repair procedures.
- Critical thinking skills used in troubleshooting, estimating and repairs in the automotive collision industry and demonstrate those skills.
- Oral and written communication skills needed in the automotive collision technology field.

**CORE CURRICULUM**

			<b>Credit Hours</b>
ACT	101	Basic Non-Structural Analysis and Damage Repair	2
ACT	102	Basic Refinishing Techniques	2
ACT	103	Advanced Non-Structural Analysis and Damage Repair	2
ACT	104	Advanced Refinishing Techniques	2
ACT	107	Auto Plastic Repair	3
ACT	108	Tinting and Blending	3
ACT	205	Structural Analysis I	4
ACT	206	Structural Analysis II	4
ACT	209	Non-Structural Repair Applications	3
ACT	210	Structural Repair Applications	3
<b>Optional:</b>			
ACT	200	Sheet Metal Fabrication (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>28-31</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

MPT	151	Shop Skills	3
MPT	165	Basic Welding	3
AMT	154	Automotive Electrical Systems	6
AMT	267	Mechanical Systems and Power Accessories	6
		<b>SUB-TOTAL</b>	<b>18</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Automotive Collision Technology (ACT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**PROGRAM TOTAL** **66-69**



**AUTOMOTIVE COLLISION TECHNOLOGY**

**47.0603**

*(One-Year Certificate in Refinishing & Non-Structural Repair)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
ACT	101	Basic Non-Structural Analysis and Damage Repair	2
ACT	102	Basic Refinishing Techniques	2
ACT	103	Advanced Non-Structural Analysis and Damage Repair	2
ACT	104	Advanced Refinishing Techniques	2
ACT	107	Auto Plastic Repair	3
ACT	108	Tinting and Blending	3
		<b>SUB-TOTAL</b>	<b>14</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
		<b>SUB-TOTAL</b>	<b>6</b>

**PROGRAM REQUIREMENTS**

MAT	030	Preparatory Mathematics	3
AMT	154	Automotive Electrical Systems	6
MPT	151	Shop Skills	3
MPT	165	Basic Welding	3
		<b>SUB-TOTAL</b>	<b>15</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Automotive Collision Technology (ACT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

**PROGRAM TOTAL** **36**



**AUTOMOTIVE COLLISION TECHNOLOGY**  
**47.0603**  
*(One-Year Certificate in Structural & Mechanical Repair)*

<b>CORE CURRICULUM</b>			<b>Credit Hours</b>
ACT	205	Structural Analysis I	4
ACT	206	Structural Analysis II	4
ACT	209	Non-Structural Repair Applications	3
ACT	210	Structural Repair Applications	3
<b>SUB-TOTAL</b>			<b>14</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>			
CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
<b>SUB-TOTAL</b>			<b>6</b>
<b>PROGRAM REQUIREMENTS</b>			
MAT	030	Preparatory Mathematics	3
AMT	267	Mechanical Systems & Power Accessories	6
MPT	151	Shop Skills	3
MPT	165	Basic Welding	3
<b>SUB-TOTAL</b>			<b>15</b>
<b>GRADUATION REQUIREMENTS</b>			
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>
<p>It is a graduation requirement of the Automotive Collision Technology (ACT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.</p>			
<b>PROGRAM TOTAL</b>			<b>36</b>

**ACT 101** Basic Non-Structural Analysis and Damage Repair. This course is an introduction to identifying, analyzing, and repairing non-structural damage to vehicles, including personal safety practices, preparation, panel replacement, and alignment. Students also work with trim, metal straightening and repair methods, moveable glass, and hardware. 2 credit hours.

**ACT 102** Basic Refinishing Techniques. This course is an introduction to automotive finishes. Topics include preparing the equipment, the surface for refinishing, and the paint and refinish materials; applying the finish; solving paint application problems; and application of the safety and environmental practices needed in the refinishing process. 2 credit hours.



**ACT 103 Advanced Non-Structural Analysis and Damage Repair.** This course is a continuation of identifying, analyzing, and repairing non-structural damage to vehicles, including personal safety practices, preparation, panel replacement, and alignment. Students continue to work with trim, metal straightening and repair methods, moveable glass, and hardware. Prerequisites: ACT 101 and ACT 102 with a grade of “C” or better. 2 credit hours.

**ACT 104 Advanced Refinishing Techniques.** In this course students continue to learn and work with automotive finishes. Topics include preparing the equipment, the surface for refinishing, and the paint and refinish materials; applying the finish; solving paint application problems; and application of the safety and environmental practices needed in the refinishing process. Prerequisites: ACT 101 and ACT 102 with a grade of “C” or better. 2 credit hours.

**ACT 107 Auto Plastic Repair.** This course covers the identification and repair process of plastic materials currently used in automotive vehicles. Prerequisites: ACT 103 and ACT 104 with a grade of “C” or better. 3 credit hours.

**ACT 108 Tinting and Blending.** This course provides students with an understanding of how light sources, pigments, and application affect color changes in the refinishing/blending process. Students will have the opportunity to apply the proper steps and techniques in a lab environment. Prerequisites: ACT 103 and ACT 104 with a grade of “C” or better. 3 credit hours.

**ACT 200 Sheet Metal Fabrication.** This course teaches the skills and use of equipment needed to perform sheet metal fabrication of components related to performance and vintage vehicles. 3 credit hours.

**ACT 205 Structural Analysis I.** Identifying, analyzing, and repairing underbody structural damage to unibody and frame vehicles. Prerequisites: ACT 107 and ACT 108 with a grade of “C” or better and MPT 165. 4 credit hours.

**ACT 206 Structural Analysis II.** Identifying, analyzing, and repairing structural damage of vehicle bodies and vehicle body components. Prerequisites: ACT 107 and ACT 108 with a grade of “C” or better and MPT 165. 4 credit hours.

**ACT 209 Non-Structural Repair Applications.** Theory/application of auto body non-structural systems. Emphasis is given to live and simulated work analysis and repair procedures according to industry specifications. Complete refinishing and color matching. Blending techniques are also included. Safety is stressed. Prerequisites: ACT 205 and ACT 206 with a grade of “C” or better and MPT 151. 3 credit hours.

**ACT 210 Structural Repair Applications.** Theory/application repair of auto body structural systems. Emphasis is given to live and simulated work analysis and repair procedures, according to industry specifications. Complete refinishing and color matching. Blending techniques are also included. Safety is stressed. Prerequisites: Completed first three semesters. Prerequisites: ACT 205 and ACT 206 with a grade of “C” or better and MPT 151. 3 credit hours.

**ACT 220 Body Repair and Painting.** This course is an independent study course designed to develop and enhance the special interests of certificate students. Projects and topics will be individualized and will include research and application of theory. Prerequisites: ACT 205 and ACT 206 with a grade of “C” or better. 4 credit hours.

**ACT 225 Collision Repair Internship.** This course will provide the student with a day-to-day knowledge of a working body shop. The student must fill out the required forms from the instructor. The instructor will visit with the student on the job to be sure that the requirements for the internship are being administered. Prerequisites: ACT 205 and ACT 206 with a grade of “C” or better. 8 credit hours.



**ACT 299 Special Topics in Automotive Collision Technology.** Special Topics in Automotive Collision Technology (ACT) may include instruction on topics not covered in other ACT courses. Topics covered in other ACT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



The Association of Technology,  
Management, and Applied Engineering

## **AUTOMOTIVE TECHNOLOGY**

### **GENERAL OPTION**

### **ELECTRIC/HYBRID VEHICLE OPTION**

### **HIGH PERFORMANCE OPTION**

### **LIGHT-DUTY DIESEL OPTION**

**47.0604**

*(Associate of Applied Science Degree)*

Linn State Technical College offers the person who wants to become a skilled automotive service technician the opportunity to work in one of the best-equipped shops in Missouri under the supervision of competent, thoroughly trained instructors. The Automotive Technology program at Linn State Technical College is one of only a select few in the country that meet the strict industry standards required for Automotive Service Excellence (ASE) certification by the National Automotive Technicians Education Foundation (NATEF). As a result of its commitment to quality automotive service technology training, Linn State Technical College has been awarded ASE MASTER certification. The Automotive Technology program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

Enrollment in the Automotive Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

Students have four Automotive Technology Associate of Applied Science degree options from which to choose. All options fully educate students in the fundamentals of the automobile field so that they have a background that supports advancement within the industry or that allows them to begin a business of their own. The General Option includes instruction on all the systems of conventional gasoline powered vehicles. The Electric/Hybrid Vehicle Option includes instruction on systems specific to electric and hybrid powered vehicles. The Light-Duty Diesel Option includes instruction on light-duty diesel engines. The High Performance Option provides training in the modification and construction of performance vehicles used in motorsports. If time allows, students in the General Option may elect to take additional courses in welding, high performance modifications, electric/hybrid systems, and diesel engines to develop additional skills and should consult their advisors if they wish to do so.

Students may also choose to pursue a one-year technical certificate in the areas of Automotive Transmission/Transaxle, Maintenance and Light Repair, Engine Performance or General Automotive. Automotive Technology certificate students receive supportive training in related fields such as shop math, metal work and technical communications.



The Automotive Technology program contributes to the green economy by teaching students to repair and maintain vehicles that may otherwise be discarded. Instruction on hybrid vehicles and alternative fuels is also included in the program. During their education, students use computers to diagnose and correct problems that affect automotive emission systems to help reduce the carbon footprint. The program is recognized by the Mobile Air Conditioning Society (MACS) as complying with the 1990 United States Environmental Protection Agency (EPA) Clean Air Act requirements for refrigerant recovery and recycling to protect the environment. Solvents and other chemicals are recycled to help reduce water, air, and soil contamination.

Students who graduate with an Associate of Applied Science degree in Automotive Technology may pursue a second Associate of Applied Science degree in Automotive Collision Technology. Basic Welding (MPT 165) is a prerequisite for Automotive Technology students who wish to obtain a second degree or certificate in Automotive Collision Technology. The courses for the second Associate of Applied Science degree in Automotive Collision Technology will be offered in the same sequence and semester that they are being taught for the full-time Automotive Collision Technology program. The second Associate of Applied Science degree in Automotive Collision Technology may be completed in two semesters if scheduling permits.

It is a graduation requirement of the Automotive Technology (AMT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**Program Mission**

The mission of the Automotive Technology program is to prepare students with the higher education, technical, and interpersonal skills needed for employment in the challenging and highly technical career of Automotive Technology, with the foundation for Automotive Service Excellence (ASE) Master Technician Certification.

**Program Goals**

The goals of the program are to provide the opportunity for students to develop:

- Effective communication skills.
- Critical thinking skills for troubleshooting and diagnostic techniques.
- Technical knowledge and understanding necessary for applied tasks in the eight Automotive Service Excellence (ASE) areas.
- Computer skills to find and research automotive data using multiple software databases and via the Internet.
- Skills in repairing and modifying automotive systems as appropriate for each program option.
- Personal social traits, which are essential for the successful automotive technician.
- A professional attitude toward the automotive industry including continuing education.

**CORE CURRICULUM**

			<b>Credit Hours</b>
AMT	101	Automotive Electrical/Electronics I	4
AMT	120	Project Management	3
AMT	145	Automotive Engine Mechanical	5
AMT	205	Automotive Braking Systems	4
AMT	206	Automotive Suspension and Steering	4
AMT	252	Automotive Drivetrains and Axles	8
<b>Optional:</b>			
AMT	191	Internship (Optional)	(6)
HEO	151	Basic Commercial Driver License (Optional)	(1)
HEO	152	Basic Commercial Driver License Lab (Optional)	(1)
<b>SUB-TOTAL</b>			<b>28-36</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>



**PROGRAM REQUIREMENTS**

		<b>General Option</b>	
AMT	138	Automotive Electrical/Electronics II	6
AMT	213	Automotive Electrical/Electronics III	8
AMT	207	Heating/Air Conditioning	5
<b>Optional:</b>			
MTT	196	Machining Essentials (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>19-22</b>

**OR**

		<b>Electric/Hybrid Vehicle Option</b>	
AMT	138	Automotive Electrical/Electronics II	6
AMT	207	Heating/Air Conditioning	5
AMT	213	Automotive Electrical/Electronics III	8
AMT	270	Electric/Hybrid Drive Systems	6
EPG	130	Generator, Alternator, and Motor Fundamentals	2
		<b>SUB-TOTAL</b>	<b>27</b>

**OR**

		<b>High Performance Option</b>	
AMT	255	Performance Suspension Design	3
AMT	260	High Performance Drivetrains	3
ACT	200	Sheet Metal Fabrication	3
MPT	165	Basic Welding	3
MPT	225	Welding and Fabrication for High Performance Vehicles	2
MTT	196	Machining Essentials	3
		<b>SUB-TOTAL</b>	<b>17</b>

**OR**

		<b>Light-Duty Diesel Option</b>	
AMT	207	Heating/Air Conditioning	5
AMT	213	Automotive Electrical/Electronics III	8
AMT	242	Light-Duty Diesel Engine Control Systems	5
MHT	255	Engines II	3
OR			
HET	255	Engines II	
MPT	165	Basic Welding	3
<b>Optional:</b>			
MTT	196	Machining Essentials (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>24-27</b>

		<b>GRADUATION REQUIREMENTS</b>	
BUS	125	Job Search Strategies	1
SEM	135	Ford Maintenance & Light Repair (MLR) Service Training Seminar	NC
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Automotive Technology (AMT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

**PROGRAM TOTAL 65-83**



**AUTOMOTIVE TECHNOLOGY  
47.0604**

*(One-Year Certificates in Automotive Transmission/Transaxle or Maintenance & Light Repair or Engine Performance or General Automotive)*

Students may select two specialized certificates or the stand-alone General Automotive Certificate.

**CORE CURRICULUM**

			<b>Credit Hours</b>
AMT	101	Automotive Electrical/Electronics I	4
AMT	138	Automotive Electrical/Electronics II	6
		<b>SUB-TOTAL</b>	<b>10</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
		<b>SUB-TOTAL</b>	<b>6</b>

**PROGRAM REQUIREMENTS**

**Automotive Transmission/Transaxle Certificate**

AMT	213	Automotive Electrical/Electronics III	8
AMT	252	Automotive Drivetrains and Axles	8
MPT	165	Basic Welding	3
MAT	030	Preparatory Mathematics	3
OR			
SPM	030	Self-paced Preparatory Mathematics	NC
<b>Optional:</b>			
AMT	120	Project Management (Optional)	(3)
SEM	135	Ford Maintenance & Light Repair (MLR) Service Training Seminar (Optional)	(NC)
		<b>SUB-TOTAL</b>	<b>19-25</b>

**OR**

**Maintenance & Light Repair Certificate**

AMT	205	Automotive Brake Systems	4
AMT	206	Automotive Suspension & Steering	4
AMT	207	Heating/Air Conditioning	5
MPT	165	Basic Welding	3
SEM	135	Ford Maintenance & Light Repair (MLR) Service Training Seminar	NC
MAT	030	Preparatory Mathematics	3
OR			
SPM	030	Self-paced Preparatory Mathematics	NC
<b>Optional:</b>			
AMT	120	Project Management (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>16-22</b>

**OR**



			<b>Engine Performance Certificate</b>		
AMT	145		Automotive Engine Mechanical		5
AMT	213		Automotive Electrical/Electronics III		8
MAT	030		Preparatory Mathematics		3
OR					
SPM	030		Self-paced Preparatory Mathematics		NC
<b>Optional:</b>					
AMT	120		Project Management (Optional)		(3)
SEM	135		Ford Maintenance & Light Repair (MLR) Service Training Seminar (Optional)		(NC)
<b>SUB-TOTAL</b>					<b>13-19</b>
<b>OR</b>					
			<b>General Automotive Certificate</b>		
SEM	135		Ford Maintenance & Light Repair (MLR) Service Training Seminar		NC
MAT	030		Preparatory Mathematics		3
OR					
SPM	030		Self-paced Preparatory Mathematics		NC
The General Automotive Certificate is a stand-alone certificate, which may not be combined with another Automotive Technology certificate. This certificate is custom-designed with instructor's permission. 16 credits of Automotive Technology courses are required in addition to the one-year certificate core curriculum and general education requirements.					16
<b>SUB-TOTAL</b>					<b>16-19</b>
			<b>GRADUATION REQUIREMENTS</b>		
BUS	125		Job Search Strategies		1
<b>SUB-TOTAL</b>					<b>1</b>
It is a graduation requirement of the Automotive Technology (AMT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.					
<b>PROGRAM TOTAL</b>					<b>30-42</b>

**AMT 101 Automotive Electrical/Electronics I.** Theory/application of the operation and repair of electrical systems generally associated with the automotive engine. Includes the discussion and use of specific hand tools and equipment. Safety is stressed. 4 credit hours.

**AMT 120 Project Management.** This course is designed to give the student the opportunity to handle problems facing management, better equipping him/her for the automotive technician career. Some topics discussed include: keeping accurate records, merchandising, writing repair orders, figuring flat rate time, handling customer relations, and terminology as applied to the automotive industry. 3 credit hours.

**AMT 138 Automotive Electrical/Electronics II.** Application/service of electrical systems associated with the automotive engine. Theory/application/operation and diagnosis of automotive fuel and emission systems. Emphasis is put on an individual component operation, advanced system diagnostics, failure analysis, and proper service procedures. Safety is stressed. Prerequisite: AMT 101 with a grade of "C" or better. 6 credit hours.



**AMT 145 Automotive Engine Mechanical.** Theory/Construction/Operation of the internal combustion engine. Emphasis is put on proper diagnosis, failure analysis, and using the proper service procedures according to manufacturers specifications. Safety is stressed. 5 credit hours.

**AMT 154 Automotive Electrical Systems.** Construction, operation and servicing of the electrical, air conditioning, and safety systems of the automobile. Battery, starting and generating systems, and power accessories are also covered. 6 credit hours.

**AMT 191 Internship (Optional).** The optional internship is a paid work experience in the automotive industry that develops and reinforces the student's skills. The minimum hours worked will be 320 hours. Only Associate of Applied Science degree students who have successfully completed at least 12 credit hours of AMT classes and earned a 2.5 GPA in all classes are eligible for the AMT internship. Prerequisites: AMT 101, AMT 138, AMT 145 or AMT 101, AMT 145, MHT 255 and Department Chair approval. 6 credit hours.

**AMT 205 Automotive Brake Systems.** Theory/Application/Service of the automotive brake systems components. Emphasis is given to live work, diagnosis, failure analysis, and following service procedures as outlined by the manufacturer. A component of electronic brake systems is also included. Safety is stressed. 4 credit hours.

**AMT 206 Automotive Suspension and Steering.** Theory/Application/Service of the automotive suspension and steering system components. Emphasis is given to live work, diagnosis, failure analysis, and following service procedures as outlined by the manufacturer. A component of electronic suspension systems and wheel alignment is also included. Safety is stressed. 4 credit hours.

**AMT 207 Heating/Air Conditioning.** Theory/Application/Service of the component functions of the heating and air conditioning systems. Emphasis is given to live work diagnosis, failure analysis, and following the proper service procedures as outlined by the manufacturers specifications. Special emphasis is put on the proper handling of refrigerants. Safety is stressed. 5 credit hours.

**AMT 213 Automotive Electrical/Electronics III.** Theory/Application/Service of electronic type power accessories with emphasis put on failure analysis and proper service procedures. Special emphasis is put on accessories such as electric windows, door locks, electric seats, cruise controls, and body computers. Will have a large component of advanced engine performance and electronic diagnostics. Safety is stressed. Prerequisite: AMT 101 with a grade of "C" or better. Corequisite: AMT 138 or AMT 242. 8 credit hours.

**AMT 242 Light-Duty Diesel Engine Control Systems.** Theory, application, and service of light-duty diesel engine fuel and electronic engine management systems. Prerequisite: AMT 101 with a grade of "C" or better. 5 credit hours.

**AMT 252 Automotive Drivetrains and Axles.** Theory, application, and service of the components used in automotive and light truck drivetrain systems. Emphasis is given to live work diagnosis, failure analysis, and following proper service procedures as outlined by the manufacturers specifications. Safety is stressed. 8 credit hours.

**AMT 255 Performance Suspension Design.** This course teaches performance suspension modifications for motorsports competition vehicles. Prerequisite: AMT 205 and AMT 206 with a grade of "C" or better. 3 credit hours.

**AMT 260 High Performance Drivetrains.** This course teaches modification and design of engines and transmissions used in high performance vehicles. Emphasis will be on safety, selecting proper components, and calculating vehicle demand. Prerequisites: AMT 145 and AMT 252 with a grade of "C" or better. 3 credit hours.

**AMT 267 Mechanical Systems and Power Accessories.** Theory/Application/Service of automobile mechanical systems as applied to collision repair. Emphasis is placed on brake, suspension, and steering systems. 6 credit hours.



**AMT 270** Electric/Hybrid Drive Systems. This course teaches the theory, application, operation, and diagnosis of automotive electrical and hybrid propulsion systems. Emphasis is on individual component operation, proper testing, and diagnosis as outlined by the manufacturer. Safety is stressed. 6 credit hours.

**AMT 299** Special Topics in Automotive Technology. Special Topics in Automotive Technology (AMT) may include instruction on topics not covered in other AMT courses. Topics covered in other AMT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



Certified Aviation Maintenance Technician  
School since 1970



The Association of Technology,  
Management, and Applied Engineering

**AVIATION MAINTENANCE**  
**47.0607 A/F - 47.0608 P/P**  
*(Associate of Applied Science Degree)*

The Aviation Maintenance program prepares individuals for employment in the aircraft maintenance industry. Aircraft mechanics are employed by the airlines, aircraft manufacturing companies, repair stations, the United States military, and general aviation fixed base operators. Some mechanics specialize in work on a particular part of an aircraft, such as metal or fabric surfaces, avionics equipment, hydraulic systems, landing gear, propellers or engines. Others, particularly those employed by the smaller fixed base operators, work on many different aircraft systems and may inspect and repair many different types of aircraft. Linn State Technical College has been certified by the Federal Aviation Administration (FAA) as an Aviation Maintenance Technician School since 1970. The Aviation Maintenance program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The program provides extensive hands-on training in small classes with well-trained teachers. Equipment and curriculum are up-to-date and include non-destructive testing, composites, electrical systems troubleshooting and reciprocating and turbine engine theory and maintenance, to name a few.

Many jobs in the aircraft maintenance industry require mechanics that are certified by the Federal Aviation Administration (FAA). Two ratings are applicable to this certification: Airframe and Powerplant. Three options are offered in Aviation Maintenance: an Associate of Applied Science (AAS) in Aviation Maintenance, a certificate in Aviation Maintenance (Powerplant), and a certificate in Aviation Maintenance (Airframe). The AAS degree program provides the experience required to obtain the aircraft mechanic certificate with Airframe and Powerplant ratings. Each certificate program provides the experience required to obtain the aircraft mechanic certificate with the rating appropriate for the program completed.

The Aviation Maintenance program is divided into three sections: General, Airframe and Powerplant. Students enrolled in the Associate of Applied Science Degree program typically complete the General and Powerplant sections by the end of the third semester, and the Airframe section by the end of the fourth semester.

Graduation requirements of the Aviation Maintenance program include: 1) earning a grade of C (70%) or better in all "Core Curriculum" courses and a math course, and 2) taking and passing the FAA General and Powerplant or Airframe Aviation Technician examinations.

**Program Mission**

The mission of the Aviation Maintenance program is to provide individuals with opportunities for educational experiences that enable them to develop the skills necessary for employment in the aviation maintenance industry.



**Program Goals**

The goals of the program are to:

- Provide the opportunity for students to develop the technical skills necessary for employment in the aviation maintenance industry.
- Assist students in their preparation to meet the technical knowledge requirement for mechanic certification, required by Federal Aviation Regulation, Part 65.
- Provide the opportunity for students to develop core skills in general education in reading, writing, mathematics, and science reasoning.

**CORE CURRICULUM**

			<b>Credit Hours</b>
TAM	107	Federal Regulations for Aviation Technicians	2
TAM	109	Aircraft Structural Materials and Corrosion Control	2
TAM	113	General Mechanics	2
TAM	125	Basic Electricity	2
TAM	127	Reciprocating Engines and Lubrication Systems	4
TAM	131	Propeller Systems	2
TAM	134	Turbine Engines and Accessory Systems	4
TAM	136	Powerplant Fuel Systems	2
TAM	139	Powerplant Electrical Systems	4
TAM	150	Physics for Aviation Maintenance Technicians	2
TAM	200	Auxiliary Systems and Inspections for Powerplants	5
TAM	208	Introduction to Aircraft Welding	2
TAM	211	Assembly and Rigging	2
TAM	213	Sheetmetal and Non-metallic Structures	4
TAM	217	Aircraft Fluid Power Systems	2
TAM	220	Aircraft Covering, Finishes and Woods	2
TAM	224	Aircraft Instrumentation and Avionics Systems	3
TAM	226	Aircraft Electrical Systems	4
TAM	228	Airframe Systems and Inspections	2
		<b>SUB-TOTAL</b>	<b>52</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>

**GRADUATION REQUIREMENTS**

BUS 125 Job Search Strategies	1
<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Aviation Maintenance program for students to: 1) earn a grade of C (70%) or better in all “Core Curriculum” courses and a math course, and 2) take and pass the FAA General and Powerplant or Airframe Aviation Technician examinations.

<b>PROGRAM TOTAL</b>	<b>72</b>
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**AVIATION MAINTENANCE**  
**47.0608**  
*(One-Year Certificate in Powerplant)*

<b>CORE CURRICULUM</b>			<b>Credit Hours</b>
TAM	107	Federal Regulations for Aviation Technicians	2
TAM	109	Aircraft Structural Materials and Corrosion Control	2
TAM	113	General Mechanics	2
TAM	125	Basic Electricity	2
TAM	127	Reciprocating Engines and Lubrication Systems	4
TAM	131	Propeller Systems	2
TAM	134	Turbine Engines and Accessory Systems	4
TAM	136	Powerplant Fuel Systems	2
TAM	139	Powerplant Electrical Systems	4
TAM	150	Physics for Aviation Maintenance Technicians	2
TAM	200	Auxiliary Systems and Inspections for Powerplants	5
<b>SUB-TOTAL</b>			<b>31</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>			
CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
<b>SUB-TOTAL</b>			<b>6</b>
<b>PROGRAM REQUIREMENT</b>			
MAT	030	Preparatory Mathematics	3
OR			
SPM	030	Self-paced Preparatory Mathematics	NC
<b>SUB-TOTAL</b>			<b>0-3</b>
<b>GRADUATION REQUIREMENTS</b>			
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>
<p>It is a graduation requirement of the Aviation Maintenance program for students to: 1) earn a grade of C (70%) or better in all “Core Curriculum” courses and a math course, and 2) take and pass the FAA General and Powerplant or Airframe Aviation Technician examinations.</p>			
<b>PROGRAM TOTAL</b>			<b>38-41</b>





**TAM 107** Federal Regulations for Aviation Technicians. This course concerns the *Federal Aviation Regulations* governing aircraft maintenance and mechanic privileges and responsibilities associated with that maintenance. Students learn research techniques on the *Avantext* software system in the computer laboratory. In addition they are taught rudimentary drawing and sketching techniques to use in filling out FAA forms, reading manuals and diagrams and how to make maintenance record entries. The general curriculum subjects included in this course and required by FAR Part 147, Appendix B, are as follows: Aircraft Drawings, Maintenance Forms and Records, Maintenance Publications, Mechanic Privileges and Limitations. 2 credit hours.

**TAM 109** Aircraft Structural Materials and Corrosion Control. Major topics in this course include structural materials identification, metalworking and fabrication processes, non-destructive testing procedures and corrosion treatment and prevention. The general curriculum subjects included in this course and required by FAR Part 147, Appendix B, are as follows: Corrosion Control and Materials and Processes. 2 credit hours.

**TAM 113** General Mechanics. This course covers aircraft weight and balance theory and terminology, FAA requirements for documentation, practical problems and application. Laboratory activities include actual weighing of an aircraft and related computations. Also included are practical problems involving aircraft alterations with related weight and balance computations, adverse loading checks, and ballast and weight shift problems. Ground handling and servicing covers shop and flight line safety, including fire safety and procedures, jacking safety and hazardous materials procedures. Towing and taxiing aircraft, including engine-starting procedures are part of the laboratory activities. Tie-down techniques, standard hand signals and fueling safety and procedures are also covered. Servicing with ground power units, oxygen and other related items used on aircraft are discussed and performed in the laboratory. Fluid lines and fittings are covered in this course. Topics covered are materials and hardware required to fabricate all types of both rigid and flexible fluid lines. Fabrication techniques and installation procedures are included in the laboratory activities. The general curriculum subjects included in this course and required by FAR Part 147, Appendix B, are as follows: Weight and Balance, Ground Operation and Servicing, Fluid Lines and Fittings. 2 credit hours.

**TAM 125** Basic Electricity. Basic electricity theory is covered in this course including static and current electricity, basic electrical units, terminology and magnetism. Circuit components are discussed and complex DC circuits are analyzed using Ohm's Law and power formulas. Different methods of generating electrical energy are covered and laboratory projects include fabrication and testing of circuits containing a variety of components. A unit on the theory, testing and maintenance of batteries rounds out the DC phase of this course. Primary and secondary batteries including lead-acid and nickel-cadmium types are included. The AC phase of the course involves mathematically analyzing inductive and capacitive circuits including power formulas. Solid-state devices are introduced and theory discussed. A final unit on testing and troubleshooting is covered in this course. Extensive laboratory projects are used in this phase. The general curriculum subject included in this course and required by FAR Part 147, Appendix B, is Basic Electricity. 2 credit hours.

**TAM 127** Reciprocating Engines and Lubrication Systems. The history, theory, design, development and maintenance of aircraft reciprocating engines and the terminology and techniques associated therewith are addressed in this course. A study of lubrication systems for both, reciprocating engines and turbine engines is also included. Laboratory activities may include disassembly, reassembly, overhaul, repair, inspection, removal, installation, rigging and testing of aircraft reciprocating engines and engine lubrication systems. This course provides the opportunity for students to develop skills in the use of maintenance publications and the documentation of maintenance activities. The powerplant curriculum subjects included in this course and required by FAR Part 147, Appendix D are as follows: Reciprocating Engines and Lubrication Systems. 4 credit hours.

**TAM 131** Propeller Systems. The lecture portion of this course addresses the history, development, theory of operation and application of fixed-pitch propellers through constant-speed propellers with reverse and feather features. In lab, students may remove, replace, inspect, service, or repair propellers, propeller accessories, or propeller auxiliary systems. The use of maintenance publications, and the documentation of maintenance activities will be emphasized. The powerplant curriculum subject included in this course and required by FAR Part 147, Appendix D is Propellers. 2 credit hours.



**TAM 134 Turbine Engines and Accessory Systems.** Thorough reviews of the history, development, design, theory and application of various types of turbine engines, and auxiliary systems for both, reciprocating engines and turbine engines, are provided in the lecture portion of this course. Lab activities may include the removal and replacement, inspection, overhaul, repair and adjustment of turbine engines, and auxiliary systems for reciprocating engines and turbine engines. The powerplant curriculum subjects included in this course and required by FAR Part 147, Appendix D, are as follows: Turbine Engines, Auxiliary Power Units, Unducted Fans, Engine Cooling Systems, Engine Exhaust and Reverser Systems, Induction and Engine Airflow Systems. 4 credit hours.

**TAM 136 Powerplant Fuel Systems.** In this course, students learn about aircraft fuels, engine fuel systems components and fuel metering devices. Lecture topics include float carburetors, pressure injection carburetors, fuel injection systems and turbine engine fuel controls. Laboratory activities may include the inspection, service and repair of fuel systems, pumps, valves, filters, and metering units. The Powerplant curriculum subjects included in this course and required by FAR Part 147, Appendix D, are Fuel Metering Systems and Engine Fuel Systems. 2 credit hours.

**TAM 139 Powerplant Electrical Systems.** Aircraft charging systems, motors and engine starting and ignition systems are the major topics in this course. In lab, students may inspect powerplant electrical systems installation, and inspect, service and repair electrical systems components. The powerplant curriculum subjects included in this course and required by FAR Part 147, Appendix D, are Engine Electrical Systems and Ignition and Starting Systems. 4 credit hours.

**TAM 150 Physics for Aviation Maintenance Technicians.** Physics concepts with particular application in the aviation maintenance field are covered in this lecture/laboratory course. Standard topics of matter, energy, work, power, force, motion, and gas and fluid mechanics are included. These principles, together with Newton's laws and atmospheric science are then used to introduce aerodynamics for fixed and rotor wing aircraft. The general curriculum subject included in this course and required by FAR Part 147, Appendix B, is Basic Physics. 2 credit hours.

**TAM 200 Auxiliary Systems and Inspections for Powerplants.** All of the subject areas in the powerplant curriculum culminate in this course, to provide students with the opportunity to hone skills learned earlier. Periodic inspections of reciprocating or turbine engines, propellers or engine accessories are typical activities in lab. These inspections include extensive research of maintenance publications and effective documentation of inspection activities. Students may also inspect, service and repair, fire protection systems and powerplant instrument systems. The powerplant curriculum subjects included in this course and required by FAR Part 147, Appendix D are as follows: Engine Fire Protection Systems, Engine Instrument Systems and Engine Inspections. Prerequisite: At least eight credit hours of course work in the powerplant curriculum, or the transfer of an equivalent course work, or documentation of significant experience in the maintenance of aircraft engines, or instructor's permission are requirements for entry into this course. 5 credit hours.

**TAM 208 Introduction to Aircraft Welding.** This course focuses on the various types of welding used with aircraft structural materials. Introduces the student to oxy-gas welding as well as arc welding. Includes introduction to soldering and brazing of steel sheet and tube steel. Students will demonstrate skills in the fabrication and repair of a steel tube cluster as outlined in AC-43.13 1B. The airframe curriculum subject included in this course and required by FAR Part 147, Appendix C, is Welding. 2 credit hours.

**TAM 211 Assembly and Rigging.** Assembly and rigging (adjustment) of aircraft primary structures (wings, stabilizers and landing gear), and primary and secondary flight controls (ailerons, rudders trim tabs, etc.) is the primary emphasis of this course. A review of aerodynamics for fixed and rotor wing aircraft is also included. The airframe curriculum subject included in this course and required by FAR Part 147, Appendix C, is Assembly and Rigging. 2 credit hours.



**TAM 213 Sheetmetal and Non-metallic Structures.** Provides foundation for understanding design and construction, as related to sheetmetal and non-metallic aircraft structures. Introduces students to the various materials used in aircraft fabrication and repair. Laboratory activities include selection and installation of various fasteners, installation of conventional rivets, sheetmetal flat layouts and rivet pattern layouts. Provides knowledge of composite structural designs, inspection methods, fabrication and repair procedures. The airframe curriculum subject included in this course and required by FAR Part 147, Appendix C, is Sheetmetal and Non-metallic Structures. 4 credit hours.

**TAM 217 Aircraft Fluid Power Systems.** This course covers physical principles and mathematical analysis of hydraulic systems, characteristics of different types of hydraulic fluids, small and large aircraft hydraulic systems and their applications, different types of hydraulic control systems and pneumatic systems. Various types of aircraft landing gear are covered, including aircraft ground steering systems, wheels, tires, braking systems, landing gear shock struts and related hardware. All types of braking systems are studied from simple mechanically operated brakes to hydraulically boosted systems with anti-skid systems on large aircraft. Aircraft tires and tubes are covered thoroughly including inspection, removal and replacement. All subjects in this course emphasize laboratory projects involving disassembly, inspection, repair and installation of components on aircraft. Retractable landing gear hydraulic systems are thoroughly studied including electrical control, position and warning systems. The airframe curriculum subjects included in this course and required by FAR Part 147, Appendix C, are as follows: Aircraft Landing Gear Systems, Hydraulic and Pneumatic Power Systems, Position and Warning Systems. 2 credit hours.

**TAM 220 Aircraft Covering, Finishes and Woods.** The covering of exterior surfaces and internal structures, to prevent corrosion, as well as to beautify, is one of the major areas of aircraft maintenance. In this course, students learn about aircraft wooden structures, fabric coverings for aircraft structures, and the various paints and sealers used to protect them. Students also learn techniques for the inspection, and preparation prior to sealing and painting of wood and metal aircraft structures, and wood, metal and fabric surfaces. The airframe curriculum subjects included in this course and required by FAR Part 147, Appendix C, are as follows: Aircraft Coverings, Aircraft Finishes, and Wood Structures. 2 credit hours.

**TAM 224 Aircraft Instrumentation and Avionics Systems.** Most aircraft operating under visual flight rules typically include instruments to indicate flight conditions such as attitude, altitude, airspeed and heading, other instruments to indicate engine and airframe systems conditions, and VHF radios for communication and navigation. A transponder, and other systems, to interact with the local air traffic control are necessary for instrument flight rules. In this course, students learn how these systems work, the regulations that pertain to them, and how to install, inspect, and check systems components for operation. The airframe curriculum subjects included in this course and required by FAR Part 147, Appendix C, are as follows: Aircraft Instrument Systems and Communication and Navigation Systems. 3 credit hours.

**TAM 226 Aircraft Electrical Systems.** This course addresses the operation and maintenance of electrical charging systems and power distribution systems for large and small aircraft as well as the fabrication and installation of electrical wiring and electrical systems components. The airframe curriculum subject included in this course and required by FAR Part 147, Appendix C is Aircraft Electrical Systems. 4 credit hours.

**TAM 228 Airframe Systems and Inspections.** Provides detailed instruction of airframe auxiliary systems. Includes cabin pressurization control, ice and rain systems, airframe fire protection and basic aircraft fuel systems. Learning opportunities include inspection, repair overhaul and servicing of such systems. Students will demonstrate troubleshooting skills using proper procedures and practices as outlined by the manufacturer. FAA airframe inspection requirements and proper logbook entries are also discussed. The airframe curriculum subjects included in this course and required by FAR Part 147, Appendix C, are as follows: Cabin Atmosphere, Ice and Rain Control Systems, Aircraft Fuel Systems, Fire Protection and Airframe Inspection. 2 credit hours.



**TAM 299 Special Topics in Aviation Maintenance.** Special Topics in Aviation Maintenance (TAM) may include instruction on topics not covered in other TAM courses. Topics covered in other TAM courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**BUSINESS SYSTEMS SPECIALIST**

**GENERAL OPTION**

**AUTOMATED ACCOUNTING SYSTEMS OPTION**

**52.1201**

*(Associate of Applied Science Degree)*

Increasing use of technology and organizational restructuring result in the need for employees to have higher levels of computer and business knowledge and associated skills. The Business Systems Specialist program is designed to meet these current business and industry trends. It also serves as a broad entry-level starting point for those individuals who are laid-off and/or who desire to transition into a new career.

Students are taught to create, implement, and use business and information systems that are essential for organizations to accomplish their mission and goals. Students learn to solve problems both manually and with the aid of information technology. The program prepares its graduates for entry-level positions such as computer support specialist; office manager; administrative services manager; executive or administrative assistant; and bookkeeping, accounting, or auditing assistant in a variety of business enterprises, government agencies, and organizations.

Students seeking an Associate of Applied Science degree may choose from two options. Both options give students a solid foundation in information systems, office and project management, accounting, analytical, and communication skills. The General Option develops additional business software and information systems skills. The Automated Accounting Systems Option builds additional accounting and business skills. Students may also choose to obtain a Business Systems Specialist certificate.

It is a graduation requirement of the Business Systems Specialist (BUS) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**Program Mission**

The program prepares graduates for entry-level business and information systems positions in a variety of organizations. Students are provided with an opportunity to develop their information systems, office and project management, accounting, analytical, and communication skills. Students learn to solve problems both manually and with the aid of information technology.

**Program Goals**

The goals of the program are to provide opportunities for students to develop:

- Oral and written communication skills.
- Analytical approaches to problem solving.
- Knowledge and skills in information technology.
- Knowledge and skills in office operations and management.
- Knowledge and skills in accounting principles, methods, systems, and internal controls.

**CORE CURRICULUM**

			<b>Credit Hours</b>
BUS	110	Microsoft Outlook	1
BUS	115	Advanced Microsoft Word	2
BUS	120	Advanced Microsoft Excel	2
BUS	150	Business Principles	3
BUS	162	Business Law	3
BUS	211	Management	3



BUS	260	Project Management	3
ACC	103	Accounting Principles I	3
ACC	110	Automated Accounting and Payroll	3
COM	211	Technical Writing	3
<b>Optional:</b>			
BUS	140	Internship I (Optional)	(4)
<b>SUB-TOTAL</b>			<b>26-30</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
<b>SUB-TOTAL</b>			<b>19</b>

**PROGRAM REQUIREMENTS**

**General Option**

BUS	106	Microsoft PowerPoint	2
BUS	109	Microsoft Publisher	2
BUS	176	Marketing	3
CPP	222	Database Systems Management and Design	3
CPP	223	Advanced Database Systems Management and Design	3
CPP	237	Internet Programming	3
NST	101	Network Fundamentals	3
<b>SUB-TOTAL</b>			<b>19</b>

**OR**

**Automated Accounting Systems Option**

ACC	104	Accounting Principles II	3
ACC	204	Managerial Accounting	3
ACC	208	Intermediate Accounting I	3
ACC	212	Income Tax	3
ACC	268	Auditing	3
BUS	171	Economics	3
<b>SUB-TOTAL</b>			<b>18</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Business Systems Specialist (BUS) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

<b>PROGRAM TOTAL</b>			<b>64-69</b>
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**BUSINESS SYSTEMS SPECIALIST**  
**52.1201**  
*(One-Year Certificate)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
BUS	106	Microsoft PowerPoint	2
BUS	109	Microsoft Publisher	2
BUS	110	Microsoft Outlook	1
BUS	115	Advanced Microsoft Word	2
BUS	120	Advanced Microsoft Excel	2
BUS	150	Business Principles	3
ACC	103	Accounting Principles I	3
ACC	110	Automated Accounting and Payroll	3
COM	211	Technical Writing	3
<b>Optional:</b>			
BUS	140	Internship I (Optional)	(4)
		<b>SUB-TOTAL</b>	<b>21-25</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
		<b>SUB-TOTAL</b>	<b>6</b>

**PROGRAM REQUIREMENTS**

CPP	222	Database Systems Management and Design	3
AND			
BUS	176	Marketing	3
OR			
ACC	104	Accounting Principles II	3
AND			
BUS	171	Economics	3
		<b>SUB-TOTAL</b>	<b>6</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Business Systems Specialist (BUS) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

**PROGRAM TOTAL** **34-38**



**BUS 106 Microsoft PowerPoint.** This course provides participants with the fundamentals through advanced features of Microsoft PowerPoint to plan, create, and produce professional presentations. The following concepts are covered: managing files; developing, organizing, editing and enhancing content; applying and modifying design templates; inserting and modifying text and images; using drawing tools; importing data from other sources; creating and modifying charts, diagrams, graphs, and tables; adding movement, interaction, sound, and music; showing movie clips; preparing presentation handouts and supplements for printing; running a slide show; preparing and broadcasting a presentation to the Web. Prerequisite: CPP 101 or CPP 102 with a grade of “C” or better. 2 credit hours.

**BUS 109 Microsoft Publisher.** This course covers the fundamentals through advanced features and functions of Microsoft Publisher. Topics include creating and editing single and multi-page publications; working with columns; importing and arranging text, pictures, and graphics; formatting and wrapping text around graphics; creating and formatting tables; creating common page elements; and working with master pages. Advanced topics such as the following are also included: how to flow text across text boxes; creating a facing-pages layout; exporting publications to PDF; and preparing publications for commercial printing. Prerequisite: CPP 101 or CPP 102 with a grade of “C” or better. 2 credit hours.

**BUS 110 Microsoft Outlook.** This course covers how to use Microsoft Outlook utilities to become proficient in using Outlook to send and receive e-mail; schedule meetings, events and tasks; make journal entries; maintain contact lists, to-do lists, and notes. Prerequisite: CPP 101 or CPP 102 with a grade of “C” or better. 1 credit hour.

**BUS 115 Advanced Microsoft Word.** This course develops advanced skills in using Microsoft Word to create and modify complex documents. The following concepts are covered: using bookmarks and hyphenation; creating annotations and macros; adding borders, frames, pictures, and graphics; using Microsoft Draw, WordArt and Equation Editor; creating tables and charts; formatting text into columns; sorting text; formatting with styles; creating outlines, fill-in forms, tables of contents and indexes. Prerequisite: CPP 101 or CPP 102 with a grade of “C” or better. 2 credit hours.

**BUS 120 Advanced Microsoft Excel.** This course teaches advanced Microsoft Excel skills. The following concepts are covered: advanced formatting and functions; interpreting and integrating data; charting; Pivot Tables; filter capabilities; problems-solving tools; and automating tasks with macros. Prerequisite: CPP 101 or CPP 102 with a grade of “C” or better. 2 credit hours.

**BUS 140 Internship I.** The internship is a work experience in business and industry that develops and reinforces the students' information systems, business, and/or accounting skills. The minimum hours worked will be 160 hours. Prerequisite: Department Chair approval. 4 credit hours.

**BUS 150 Business Principles.** This course examines the business system and the environment in which it operates. The student is provided with a basic understanding and overview of the role of business. The types of ownership, management fundamentals, financial control, production, marketing, business law, and human resources management are examined. 3 credit hours.

**BUS 162 Business Law.** Introduction to law and courts; discussion of business relations and their legal aspects; cases and problems on law of contracts, personal property, sales, bailment, agencies, negotiable instruments, real and chattel mortgages. 3 credit hours.

**BUS 171 Economics.** An introduction to economics with emphasis on fundamental principles and their applications to current questions. 3 credit hours.

**BUS 176 Marketing.** This is an introductory course which deals with such aspects of marketing as retailing, wholesaling, advertising, pricing, and merchandising. The course will present a realistic and objective account of marketing. 3 credit hours.



**BUS 211 Management.** An introductory course on the basic concepts of organization and management with discussion on applications to operations and personnel management. 3 credit hours.

**BUS 235 Information Design and Presentation.** The student learns to design, lay out, edit, and produce a publication electronically, using a personal computer, word processing and graphics software, and a desktop publishing program. In addition to desktop publishing, the student will learn the basics of a presentation software program. This course emphasizes desktop and application of information design and professional presentation for business using microcomputer software. 3 credit hours.

**BUS 260 Project Management.** This course covers Project Management which builds a foundation for tomorrow's managers. Students gain understanding through project analysis, which includes both successful and failed project examples. Project management methods, tools, and software are applied to group projects. 3 credit hours.

**BUS 299 Special Topics in Business Systems Specialist.** Special Topics in Business Systems Specialist (BUS) may include instruction on topics not covered in other BUS courses. Topics covered in other BUS courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## COMMERCIAL TURF & GROUNDS MANAGEMENT

01.0607

*(Associate of Applied Science Degree)*

The Associate of Applied Science degree program in Commercial Turf & Grounds Management is designed to prepare students to enter careers as assistant golf course superintendents or as specialists in other areas of turf and landscape management. Graduates may find employment in maintaining golf courses, parks, recreational facilities as well as grounds of large commercial buildings, malls and college campuses.

The *Golf Course Superintendents Association of America (GCSAA)* estimates the average salary of an assistant superintendent at an 18-hole golf course in Missouri to be \$31,762 compared to a national average of \$34,586. The same organization also reports that the superintendent at an 18-hole course in Missouri has an average salary of \$64,316 with a national average of \$68,459 ([GCSAA 2005 Compensation and Benefits Report](#).)

According to the *Professional Landcare Network (PLANET)*, there are ample career opportunities in the green industry. Recent commercial and residential construction has increased the demand for qualified lawn care and landscape maintenance technicians who design, install, and care for these properties. In 2006, the *U.S. Department of Labor Bureau of Labor Statistics* estimates that first-line supervisors of landscaping and lawn care workers earned an average of \$43,170 in Missouri. Employment of these supervisors is expected to increase by about 22 percent between 2002 and 2010.

The turf management, landscape, and horticulture industry is at the forefront of the green revolution and accounts for sales of more than \$25 billion annually. Commercial Turf & Grounds Management program contributes to the green economy by emphasizing the responsible use of products and appropriate plant selection to maximize the environmental benefits of healthy lawns and landscapes.

The Associate of Applied Science degree program at Linn State Technical College is unique in that some courses are delivered in eight-week blocks. Internships are required to earn a degree and students finish the first year and second year curriculum in early March respectively. Graduates as well as interns are available to industry in early March when golf courses, landscapers and lawn care companies are actively looking for qualified personnel. The curriculum is rigorous, fast-paced and designed to emphasize problem solving skills as well as critical thinking. The program is both physically and mentally challenging. Classes are small and students receive individualized attention as well as hands-on training. Students will complete the college's core of general education courses in order to receive a degree.

Students may also choose to pursue a one-year certificate in the technical areas of Turfgrass Management and/or Landscape Management. Commercial Turf & Grounds Management certificate students receive supportive training in related turf and landscape fields; equipment operations and maintenance; applied math; pest, weed, and disease control; and communications.

### **Program Mission**

The mission of the Commercial Turf & Grounds Management program is to provide the diverse commercial turf and grounds industries of Missouri and beyond with skillful and knowledgeable employees who possess the ability to quickly advance and become members of the leadership team while earning profitable compensation.

### **Program Goals**

The goals of the program are to provide the student the opportunity to develop:

- Knowledge and skills necessary to succeed in the commercial turf and grounds management industry.
- Attitudes to assure an appreciation of the dignity of work and the satisfaction of a job well done.
- Knowledge and/or credentials necessary to obtain certain state and professional licensures and/or certifications.
- Analytic problem solving and critical thinking skills.



**CORE CURRICULUM**

			<b>Credit Hours</b>
CTG	106	Fundamentals of Turf and Grounds	3
CTG	110	Soils & Fertilizers	3
CTG	109	Equipment Operations and Maintenance	3
CTG	116	Plant Propagation	3
CTG	107	Turfgrass Management I	3
CTG	117	Commercial Site Contracting	3
CTG	120	Commercial Turf & Grounds Internship	8
CTG	201	Weeds and Diseases	3
CTG	204	Insects and Pests	3
CTG	209	Landscape Design and Installation	3
CTG	206	Irrigation & Drainage	3
CTG	216	Woody Plant Identification	3
CTG	217	Herbaceous Plant Identification	3
Any two of the following three:			
CTG	207	Turfgrass Management II	3
CTG	210	Computer Aided Landscape Design	2
CTG	220	Basic Shop for Horticulture	2
<b>SUB-TOTAL</b>			<b>48-49</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
	Must Include:	PHY 103/104 Environmental Science	4
		OR	
		A science course with lab approved by CTG department chair.	4
<b>SUB-TOTAL</b>			<b>19</b>

**PROGRAM REQUIREMENTS**

BUS	211	Management	3
CTG	105	Missouri Pesticide Application	1
<b>SUB-TOTAL</b>			<b>4</b>

**\*GRADUATION REQUIREMENTS**

SEM	110	Spanish Language and Hispanic Culture	NC
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

**PROGRAM TOTAL** **72-73**

**\*NOTE:** *Graduation requirements also include:  
CPR & Safety Certification*



**COMMERCIAL TURF & GROUNDS MANAGEMENT**

**01.0607**

*(One-Year Certificates in Turfgrass Management and/or Landscape Management)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
CTG	105	Missouri Pesticide Application	1
CTG	106	Fundamentals of Turf and Grounds	3
CTG	109	Equipment Operations and Maintenance	3
CTG	117	Commercial Site Contracting	3
CTG	201	Weeds and Diseases	3
CTG	204	Insects and Pests	3
<b>Optional:</b>			
CTG	120	Commercial Turf & Grounds Internship (Optional)	(1-8)
<b>SUB-TOTAL</b>			<b>16-24</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
<b>SUB-TOTAL</b>			<b>6</b>

**PROGRAM REQUIREMENTS**

**Turfgrass Management Certificate**

CTG	107	Turfgrass Management I	3
CTG	110	Soils & Fertilizers	3
CTG	206	Irrigation & Drainage	3
CTG	207	Turfgrass Management II	3
<b>SUB-TOTAL</b>			<b>12</b>

**OR**

**Landscape Management Certificate**

CTG	209	Landscape Design and Installation	3
CTG	210	Computer Aided Landscape Design	2
CTG	216	Woody Plant Identification	3
CTG	217	Herbaceous Plant Identification	3
<b>SUB-TOTAL</b>			<b>11</b>

**GRADUATION REQUIREMENTS**

SEM	110	Spanish Language and Hispanic Culture	NC
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

**PROGRAM TOTAL** **34-43**



**CTG 105** Missouri Pesticide Application. A course designed to guide students in pursuit of the Missouri Category 3 Pesticide Applicator's License. This license is only available through the Missouri Department of Agriculture. 1 credit hour.

**CTG 106** Fundamentals of Turf and Grounds. A course designed to introduce students to fundamental terminology, theories, principles and practices that are a necessity for any person pursuing a career in specialized professions of turf and grounds. 3 credit hours.

**CTG 107** Turfgrass Management I. A course designed to introduce students to turfgrasses common to Missouri and the transition zone. Emphasis will be placed upon turfgrass structures as a means of identification as well as turfgrass characteristics and their usage. 3 credit hours.

**CTG 109** Equipment Operations and Maintenance. A course emphasizing principles of machinery operation and maintenance common in the turf and grounds industry. Emphasis will be placed upon proper adjustment, calibration, repair and safety. 3 credit hours.

**CTG 110** Soils and Fertilizers. A study in the origin and formation of soils with emphasis on physical and biological properties including basic principals of soil dynamics, texture, moisture, and organic matter. Chemical properties of fertilizer and use in relation with soil properties, environmental conditions and applications are considered. Economic factors of macronutrients and micronutrients are emphasized as well. 3 credit hours.

**CTG 116** Plant Propagation. A course containing the fundamental principles involved in plant propagation, both sexual and asexual. Students will learn many useful techniques of propagating plants. 3 credit hours.

**CTG 117** Commercial Site Contracting. An applied mathematics course designed to teach skills utilized on a daily basis by professional turf and grounds technicians. Emphasis will be placed upon business math, bidding, and related fundamental math skills. Prerequisite: MAT 030 with a grade of "C" or better or SPM 030 with a passing grade. 3 credit hours.

**CTG 120** Commercial Turf and Grounds Internship. Field-based learning experience that combines study, observation, and supervised occupational/employment with an agricultural business, organization, or government agency in the commercial turf and grounds industry. Students will use this opportunity to apply horticultural, leadership, communications and business theories learned in a practical context. The student intern, internship supervisor, and college coordinator develop an individual internship plan. Prerequisite: Department Chair approval. 1 to 8 credit hours.

**CTG 201** Weeds and Diseases. A course designed to introduce students to common weeds and diseases of ornamentals and turfgrasses. Identification and control are emphasized. 3 credit hours.

**CTG 204** Insects and Pests. Emphasis on identification of insects and other pests on ornamentals and turfgrasses. Control of insects will be discussed using Integrated Pest Management and pesticides. 3 credit hours.

**CTG 206** Irrigation and Drainage. A course designed to introduce students to landscape and golf course irrigation systems, their design and installation as well as drainage. Special emphasis will be placed upon irrigation hydraulics and irrigation efficiency. 3 credit hours.

**CTG 207** Turfgrass Management II. Designed to provide advanced establishment skills in the maintenance of turf areas pertaining to golf courses, athletic fields, parks, and sod producers. Includes golf course design, athletic field maintenance, fertilization, and mowing. Provides information for turf and grounds professionals in the maintenance and improvement of turfgrass playing areas. Methods of improving management practices, interpersonal skills, as well as leadership skills will be stressed. Prerequisite: CTG 107 with a grade of "C" or better. 3 credit hours.



**CTG 209 Landscape Design and Installation.** A study of the principals of landscape design including an appreciation of various artistic and design theories utilized to produce a professional presentation. Emphasis is placed upon practical application as well as installation practices. 3 credit hours.

**CTG 210 Computer Aided Landscape Design.** A course designed to utilize the skills developed in landscape design on a personal computer. The landscape design process will be made easier, and will come to life with the use of various design software and databases. Prerequisite: CTG 209 with a grade of “C” or better. 2 credit hours.

**CTG 216 Woody Plant Identification.** A study in identification of deciduous and evergreen trees and shrubs that are commonly utilized in the landscape industry. Techniques in maintenance of ornamentals will be presented emphasizing function in the landscape. Methods of pruning trees and shrubs will also be demonstrated as well as ornamental attributes, cultural requirements and adaptability in urban and suburban environments. 3 credit hours.

**CTG 217 Herbaceous Plant Identification.** A study in the identification of herbaceous plants, their selection, use and maintenance in landscaping. Emphasis will be given to culture, function and individual characteristics. 3 credit hours.

**CTG 220 Basic Shop for Horticulture.** A course designed to provide students with a general knowledge of basic shop principles and practices that are common in the commercial turf and grounds industry. Students will learn how to select and utilize various tools and equipment commonly found in the shop. Basic welding and grinding techniques will be emphasized and students will be exposed to small engine maintenance and basic hydraulics. Shop safety will be emphasized in every phase of this course. 2 credit hours.

**CTG 299 Special Topics in Commercial Turf & Grounds Management.** Special Topics in Commercial Turf & Grounds Management (CTG) may include instruction on topics not covered in other CTG courses. Topics covered in other CTG courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



The Association of Technology,  
Management, and Applied Engineering

## **COMPUTER PROGRAMMING**

### **GENERAL OPTION**

### **WEB DESIGN OPTION**

#### **11.0201**

*(Associate of Applied Science Degree)*

Graduates of this program are taught the technical competencies required to be productive in an entry-level programming position using multiple programming languages. The program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

Students have two programming options from which to choose. Both options give students a solid foundation in operating platforms, programming, database systems, system analysis and design as well as the opportunity to develop their skills in internship experiences. The General Option exposes students to many business related languages giving them a choice for advanced level coursework. The Web Design Option focuses on programming languages used in web design.

Students are also exposed to networking concepts and troubleshooting on both PCs and the AS/400. Classes are small and held in well-equipped computer labs supervised by qualified instructors. Individualized attention, focus on theory and hands-on experience characterize the Computer Programming Department at Linn State Technical College.

It is a graduation requirement of the Computer Programming (CPP) program options for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

#### **Program Mission**

The mission of the Computer Programming program is to offer a highly specialized, advanced technical education and interpersonal skills necessary for a challenging career as a Computer Programmer. The program offers two options and advanced course topics in which students can specialize. Oral and written communications are a part of the technical education as well as in the general education courses.

#### **Program Goals**

The goals of the program are to:

- Assure the program offers the opportunity for students to develop oral and written communication skills.
- Assure the program offers the opportunity for students to develop analytical approaches to problem solving.
- Provide an environment that allows the opportunity to develop the knowledge and skills in programming in C#, JAVA, COBOL, HTML, and Visual Basic.
- Provide an environment that allows the opportunity to develop the knowledge and skills in database management.
- Provide an environment that allows the opportunity to develop the knowledge and skills in web design.



**CORE CURRICULUM**

			<b>Credit Hours</b>
CPP	122	Visual Basic Programming	3
CPP	140	Internship I (Required)	4
CPP	215	Java Programming	3
CPP	222	Database Systems Management and Design	3
CPP	223	Advanced Database Systems Management and Design	3
CPP	245	C# Programming	3
CPP	237	Internet Programming	3
NST	101	Network Fundamentals	3
BUS	150	Business Principles	3
BUS	260	Project Management	3
COM	211	Technical Writing	3
<b>Optional:</b>			
CPP	141	Internship II (Optional)	(4)
<b>SUB-TOTAL</b>			<b>34-38</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)		19
Must Include: PHY 101/102 College Physics		4
<b>SUB-TOTAL</b>		<b>19</b>

**PROGRAM REQUIREMENTS**

**General Option**

CPP	125	COBOL Programming Language	3
CPP	133	Operating Platforms	3
CPP/ NST	Elective	Student must complete at least nine additional credit hours by selecting three approved CPP courses or two approved CPP courses and one approved NST course.	9
<b>SUB-TOTAL</b>			<b>15</b>

**OR**

**Web Design Option**

CPP	116	Graphic Design	3
CPP	218	Internet Programming II	3
NST	205	Linux Administration and Installation	3
NST	210	Microsoft Network Administration	3
CPP	Elective	Student must complete at least three additional credit hours by selecting one approved CPP courses.	3
<b>SUB-TOTAL</b>			<b>15</b>



BUS	125	<b>GRADUATION REQUIREMENTS</b>	
		Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Computer Programming (CPP) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**PROGRAM TOTAL 69-73**

**CPP 101** Introduction to Microcomputer Usage. An introductory course in the fundamentals of using computer applications. 3 credit hours.

**CPP 102** Advanced Microcomputer Usage. This course emphasizes advanced features of word processing, database, spreadsheet and presentation software as well as a review of the operating system. The focus is on comprehensive projects that include using advanced word processing features, developing database design and management skills, creating spreadsheet models and macros, designing and creating multi-media presentations, and creating advanced projects that integrate computer applications. 3 credit hours.

**CPP 104** Microsoft Access. This course introduces Microsoft’s Access database management system. Topics include creating a database, using forms to enter and modify data, and displaying information using reports and queries. 1 credit hour.

**CPP 112** Computer Concepts. Survey of electronic data processing equipment and applications. Course will include historical background, data representation, storage media, programming concepts, procedures, and controls with student access to microprocessors. 3 credit hours.

**CPP 116** Graphic Design. This course offers an introduction to the principles of visual communication for both print and online publications. Utilizing the computer, students will explore graphic design concepts through the study of color, form, typography, and composition as well as practice integrating language and communicating ideas through text and imagery. 3 credit hours.

**CPP 120** Introduction to Computer Programming. Study of programming logic and introduction to code structures like loops, conditional statements and modules. Class also demonstrates popular programming languages. 2 credit hours.

**CPP 122** Visual Basic Programming. An intermediate programming course utilizing Visual Basic to illustrate fourth-generation languages. Students gain experience in programming Windows-style interfaces and writing object-oriented code. 3 credit hours.

**CPP 125** COBOL Programming Language. A computer problem solving and programming course using COBOL as a vehicle language. The course covers writing programs involving computations, moving data, designing and debugging programs, sorting, selection control and data validation. This course is a combination of lecture and lab. 3 credit hours.

**CPP 126** RPG Programming Language. An advanced course in RPG/400 programming, the course covers creating, updating and processing physical files for the purpose of programming complicated reports. Iteration, selection and complex mathematical computations are also covered. 3 credit hours.

**CPP 127** Lotus Notes. This course covers the set-up, maintenance, and troubleshooting of a variety of collaborative applications in a Lotus Notes environment. 3 credit hours.



**CPP 133 Operating Platforms.** This course presents elements of DOS, Windows, UNIX and the AS/400 operating systems. Students explore the similarities and differences of these operating systems in a hands-on environment. 3 credit hours.

**CPP 140 Internship I.** The internship is a work experience in business and industry that develops and reinforces the students computer skills. The minimum hours worked will be 280 hours. Prerequisite: Department Chair approval. 4 credit hours.

**CPP 141 Internship II.** This internship is optional. This will be a work experience in business and industry that develops and reinforces the students computer skills. The minimum hours worked will be 280 hours. This course requires the permission of the department. Prerequisites: CPP 140 and Department Chair approval. 4 credit hours.

**CPP 212 Visual Basic Programming II.** This is an advanced programming course utilizing Visual Basic. Students build on their experience by programming Windows-style interfaces and writing object-oriented code. Prerequisite: CPP 122. 3 credit hours.

**CPP 215 Java Programming.** This course is an introduction to Java programming which involves designing, writing and debugging Java programs. 3 credit hours.

**CPP 217 Mobile Applications.** This course is an introduction to designing mobile applications for use on devices such as smart phones. Students will gain experience creating, revising, and testing mobile applications. 3 credit hours.

**CPP 218 Internet Programming II.** This is an advanced course using the languages of the Internet, which includes HTML, Java, CGI and other advances. Students will gain experience in web site management. Prerequisite: CPP 237. 3 credit hours.

**CPP 222 Database Systems Management and Design.** Study of database concepts and structures, design of database systems, and data management are covered in this course. Students utilize SQL and an AS/400 system as well as a PC-based database management system to apply concepts learned in lecture. 3 credit hours.

**CPP 223 Advanced Database Systems Management and Design.** This course covers the use of Structured Query Language (SQL) or Microsoft Access as relational database management systems. Prerequisite: CPP 222. 3 credit hours.

**CPP 225 Control Language Programming.** This course develops the ability to code, debug and execute control language (CL) programs utilizing the basic features of the language. Topics include the role of control language in relation to other languages, input and output in CL, and testing and debugging CL programs. 4 credit hours.

**CPP 230 C++ Programming Language I.** An introduction to programming in C++, topics covered include objects, methods, hierarchy, functions, format strings, identifiers, control and conditional statements, various operators, types, arrays, pointers and strings. 3 credit hours.

**CPP 231 Advanced COBOL Programming Language.** This course is a continuation in the study of COBOL. Emphasis is placed on advanced table processing, file maintenance and interactive programming. Prerequisite: CPP 125. 3 credit hours.

**CPP 232 GIS Database Systems.** An introduction to Geographic Information Systems (GIS) database management and design. This course is a combination of lecture and lab. Prerequisites: CPP 222 and CPP 223. 3 credit hours.



**CPP 237 Internet Programming.** An introduction to the programming languages of the Internet, languages covered are HTML, CGI, and Java. Topics include creation of Internet homepages, site management, creation of applets, handling forms and Internet security. 3 credit hours.

**CPP 239 Perl Programming.** This course covers a thorough introduction to the Perl Programming language. It includes development and maintenance of portable scripts useful for system management, data manipulation, and WEB CGI programming. 3 credit hours.

**CPP 240 C++ Programming Language II.** An advanced course in computer programming using the C++ language for implementation. This course covers the following areas: Data files, arrays, sets linked lists, trees, queues and stacks. Difference search-and-sort algorithms will also be discussed. This course is a combination of lecture and lab. Prerequisite: CPP 230. 3 credit hours.

**CPP 245 C# Programming.** This course offers an introduction to C# Programming which includes problem solving and programming. C# involves designing, writing, and debugging programs. 3 credit hours.

**CPP 250 CL Programming - AS400.** This course will prepare students with a basic understanding of Control Language Programming, message handling and debugging techniques. Students will also be introduced to advanced CL programming techniques such as OPNQRYP creating their own commands and applying contextual help to their commands. 3 credit hours.

**CPP 299 Special Topics in Computer Programming.** Special Topics in Computer Programming (CPP) may include instruction on topics not covered in other CPP courses. Topics covered in other CPP courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## CONSTRUCTION & CIVIL TECHNOLOGY

### 15.0201

*(Associate of Applied Science Degree)*

Construction industry employment currently accounts for approximately ten percent of the total workforce. Recent reports by the Department of Labor indicate that over the next several years this percentage will likely increase. Nationwide, approximately 10 million construction workers are employed.

The demand for construction technicians and managers is expected to have ten percent employment growth between 2006 and 2016<sup>2</sup> as the level of construction activity and complexity of construction projects continue to grow. In addition, many job openings will result annually from the need to replace workers who transfer to other occupations, leave the labor force and/or retire. Increased spending on the Nation's infrastructure -- highways, bridges, dams, water and sewage systems and electric power generation and transmission facilities -- will result in a greater demand for construction managers, engineers and civil technicians. The increasing complexity of construction projects as well as the proliferation of laws setting standards for buildings and construction materials will increase the demand for applicants in this field.

Traditionally, persons advance to construction management positions after having substantial experience as construction craft workers or having worked as construction supervisors or as independent contractors. With the recent rapid changes in technology this is no longer the case. Construction managers in the 21<sup>st</sup> century will require considerably more technical training as they face increasingly more complex challenges. They will require significantly more and better professional technical training as they oversee the development, construction/reconstruction and maintenance of the nation's infrastructure and related civil works. Tomorrow's construction manager will be given the designs for buildings, roads, bridges, or other projects and they will then oversee and execute the organization, scheduling and implementation of those designs. They will be responsible for coordinating and managing people, materials and equipment, budgets, schedules and contracts and the safety of employees and the general public.

The Linn State Technical College Construction & Civil Technology curriculum is designed specifically to meet these challenges. Included in this curriculum are professional courses in surveying, scheduling, cost control, construction methods, construction materials and construction safety as well as training on specific systems necessary to assure a functional and economic project.

It is a graduation requirement of the Construction & Civil Technology (CCT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

#### **Program Mission**

The mission of the Construction & Civil Technology program is a specialized technical program offering associate-level advanced technical education in current and future civil and construction engineering curriculums devoted to the development of engineering technicians, material testing personnel, land surveyors, construction estimators, construction management trainees and other personnel engaged in the fields of construction and civil technology.

#### **Program Goals**

The goals of the program are to assure that the student:

- Has the opportunity to develop oral and written communication skills that will enhance their ability to secure and maintain meaningful employment in the construction and civil technology industry.
- Has the opportunity to develop and demonstrate analytical problem solving and critical thinking skills necessary for employment in the construction and civil technology industry.
- Is given the opportunity to develop a professional attitude as well as leadership and management skills through in-class team projects and campus affiliated organizations.
- Is given the opportunity to earn industry specific certifications.

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<sup>2</sup> "Occupational Outlook Handbook, 2008-09 Edition." bls.gov/oco/. 2009. Bureau of Labor Statistics, United States Department of Labor. 4 Nov. 2008. <<http://www.bls.gov/oco/pdf/ocos112.pdf>>.



- Is given the opportunity to expand their knowledge of the construction industry through relevant course work, field trips to construction sites, and industry guest speakers on campus.

**CORE CURRICULUM**

			<b>Credit Hours</b>
CCT	106	Construction Mathematics with Applied Trigonometry	4
CCT	135	Engineering Documents	3
CCT	140	Surveying I w/Lab	3
CCT	147	Construction Techniques and Codes	3
CCT	195	Construction Safety	3
CCT	202	Construction Materials Testing w/Lab	3
CCT	208	Construction Estimating w/Lab	4
CCT	215	Environmental & Construction Site Analysis	3
CCT	220	Contract Administration/Contract Law	3
CCT	271	Construction Management	3
<b>Optional:</b>			
CCT	191	Civil/Construction Internship (Optional)	(6)
		<b>SUB-TOTAL</b>	<b>32-38</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

EMS	246	Statics	5
EMS	247	Strength of Materials	5
DDT	111	Civil Drafting	3
DDT	183	Fundamentals of Computer Aided Drafting (CAD)	3
		<b>SUB-TOTAL</b>	<b>16</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Construction & Civil Technology (CCT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**PROGRAM TOTAL**

**68-74**

**CCT 106** Construction Mathematics with Applied Trigonometry. This course focuses on practical mathematical computations required for various construction and civil applications. Areas, volumes, conversions, scaling and measurement of materials, and applied trigonometry are emphasized. 4 credit hours.

**CCT 135** Engineering Documents. Blueprint reading, development and analysis of computer aided project plans and specifications, understanding electrical and mechanical schematics and other documents used in construction. 3 credit hours.

**CCT 140** Surveying I w/Lab. A basic course in surveying including theory, principles, and practices of surveying with emphasis on basic computations and safe operation of equipment including the surveyor’s tape, level, and total station. Prerequisite: CCT 106. 3 credit hours.



**CCT 145 Fundamentals of Land Surveying.** This course teaches elements that provide the student with the appropriate knowledge to perform any property survey. The student will examine evidence of ownership, historical information, property descriptions and legal requirements for recording documents. Applications of the Missouri Minimum Standards, American Land Title Association (ALTA)/American Congress on Surveying & Mapping (ACSM) Surveys and FEMA Certifications are also studied. 3 credit hours.

**CCT 147 Construction Techniques and Codes.** An introductory course in construction management, which provides a survey of light, civil, heavy highway and utility construction practices. Includes introduction to use of national, state, and local regulations applicable to specifications and performance of building construction standards. 3 credit hours.

**CCT 191 Civil/Construction Internship.** A planned work experience in an industry or business directly related to the implementation and management of a construction project. The student will be employed directly by an industry or business, and both parties will submit reports and evaluations of experiences to the Department Chair. 6 credit hours.

**CCT 195 Construction Safety.** This course reviews existing occupational safety and health standards and codes as they relate to the construction industry, and the practices utilized to comply with these regulations. Students who successfully complete this class will be prepared to complete industry safety certification tests. 3 credit hours.

**CCT 202 Construction Materials Testing w/Lab.** Construction materials testing and inspection procedures in laboratory and field situations. Testing soils, aggregates, concrete, and asphalt relative to AASHTO, ASTM and other construction testing standards, maintaining laboratory reports and performing hands-on as well as simulated field inspections. 3 credit hours.

**CCT 208 Construction Estimating w/Lab.** A study in estimating techniques and methods pertaining to residential, commercial, industrial and civil construction. Quantity takeoffs, unit pricing, estimate development, blueprint reading, resource pricing, and bidding procedures will all be covered. Introduction to computer estimating using estimating software. Prerequisites: CCT 106 and CCT 147. 4 credit hours.

**CCT 215 Environmental and Construction Site Analysis.** This course will focus on environmental issues relating to water and soils. Topics include the basics of hydrology, fluids and hydraulics. Water and wastewater treatment systems, along with soil and water pollution issues and related erosion issues will also be covered. 3 credit hours.

**CCT 220 Contract Administration/Contract Law.** Administration and understanding of construction contracts, contract documents, contract law, claim avoidance, record keeping, taxes, insurance and bonds, case studies. Subjects to be covered include types of contracts, conditions of contract, interpretation of contracts, preparation of legal bids, termination of contracts, disputes, ethics and professional liability. 3 credit hours.

**CCT 230 Surveying II w/Lab.** This course teaches the theory and practice of highway and railroad surveying. Geographic Information Systems (GIS) and Geographic Positioning Systems (GPS) are introduced. Prerequisite: CCT 140. 3 credit hours.

**CCT 235 Legal Aspects of Boundary Surveying.** This course includes legal principles of surveying; Missouri survey law; and principles of boundaries, property, monumentation, deed interpretations, professional liability and ethics. Prerequisite: CCT 140 or CCT 145. 3 credit hours.

**CCT 271 Construction Management.** This course is a study of the plan and design of major construction projects incorporating case studies, site visits to existing projects under construction, and course materials presented in the CCT curriculum. Students will be required to complete class projects that identify and describe components of the construction process and estimates of the resources required to complete the projects. Written and oral presentations of the projects will be required. 3 credit hours.



**CCT 299 Special Topics in Construction & Civil Technology.** Special Topics in Construction & Civil Technology (CCT) may include instruction on topics not covered in other CCT courses. Topics covered in other CCT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**DESIGN DRAFTING TECHNOLOGY**  
**15.1301**  
*(Associate of Applied Science Degree)*

Linn State Technical College's Design Drafting Technology (DDT) program has been awarded program certification by the American Design Drafting Association (ADDA), a nationally recognized professional drafting association, which assures a quality program that benefits both education and industry. The DDT program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). Graduates of this program are qualified to take positions as industrial and architectural designers, engineering technicians, cost estimators, and quality assurance technicians. Drafting and design technicians often assist engineers and architects with design and development work.

Drawings are produced by using standard drafting equipment or by using computer aided drafting (CAD). Using engineering data, specifications and various equipment, drafting technicians assist in determining design changes and production costs. They may also be required to apply their knowledge to solve particular design problems such as those involving tolerance, stress, strain, bending and compression.

Most drafting technicians work from rough sketches, specifications and technical data furnished by engineers. Their job is to transform these ideas into precise drawings. Drafting technicians use handbooks and tables for computations concerning strength, reliability and cost of materials.

The Design Drafting Technology program of Linn State Technical College is thorough and comprehensive, with a balanced mix of mechanical, architectural, civil, and structural drafting. The department has two state-of-the-art CAD labs with AutoCAD, Autodesk Inventor, SoftPlan, Autodesk Revit, and MicroStation software. Students work on traditional drawing boards and networked PC's. Students are scheduled in small classes to ensure individual attention and quality instruction. The Associate Degree program is rounded out with supporting math and communications courses. A drafting internship is available for students after the completion of specific course work. An internship is not a program requirement for graduation.

Due to the green revolution, there has been a fundamental change in the way building projects are approached. Today's skilled drafting technician needs to understand the fundamental concepts associated with improving environmental performance on every project. The Design Drafting Technology program contributes to the green economy by emphasizing the fundamental concepts of sustainable design, green building practices, and why sustainability is important. The program also expands the discussion of green building strategies and technologies by studying the methods being used worldwide.

Enrollment in the Design Drafting Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

It is a graduation requirement of the Design Drafting Technology (DDT) program for students to earn a grade of "C" or better in all "Core Curriculum" courses.



**Program Mission**

The Design Drafting Technology program is a technical program constructed to provide to the students the opportunity to develop technical knowledge, drafting skills, math skills, and effective communications skills which enable them to take positions in industry as industrial and architectural designers, engineering technicians, cost estimators and quality assurance technicians in the fields of mechanical, architectural, civil, and structural drafting.

**Program Goals**

The goals of the program are to:

- Assure that the student is given the opportunity to attain the technical knowledge to transform ideas to precise drawings using problem-solving skills.
- Assure that the student is given the opportunity to attain the drafting skills, by manual and computer methods, using state-of-the-art equipment and software.
- Assure that the student has the opportunity to attain math skills to solve design problems and compute strengths, reliability, and cost.
- Assure that the student has the opportunity to attain effective communications skills.

**CORE CURRICULUM**

			<b>Credit Hours</b>
DDT	111	Civil Drafting	3
DDT	150	Fundamentals of Drafting	3
DDT	153	Industrial Graphics	3
DDT	151	Mechanical Drafting with Dimensioning and Tolerancing	3
DDT	154	Industrial Design	3
DDT	183	Fundamentals of Computer Aided Drafting (CAD)	3
DDT	184	Advanced Applications of Computer Aided Drafting and Design (CADD)	3
DDT	250	Residential Architectural Drafting	3
DDT	252	Structural Steel Drafting	3
DDT	253	Residential Architectural Detailing and Design	3
DDT	254	Structural Detailing and Design	3
<b>Optional:</b>			
DDT	163	Design Drafting Internship (Optional)	(6)
MTT	240	Solid Modeling Essentials (Optional)	(3)
<b>SUB-TOTAL</b>			<b>33-42</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)		19
Must Include: PHY 101/102 College Physics		4
<b>SUB-TOTAL</b>		<b>19</b>

**PROGRAM REQUIREMENTS**

MAT	121	Trigonometry	3
EMS	246	Statics	5
EMS	247	Strength of Materials	5
COM	211	Technical Writing	3
<b>SUB-TOTAL</b>			<b>16</b>



BUS	125	<b>GRADUATION REQUIREMENTS</b>	
		Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Design Drafting Technology (DDT) program for students to earn a grade of “C” or better in all “Core Curriculum” courses.

**PROGRAM TOTAL 69-78**

**DDT 111 Civil Drafting.** A basic course in engineering drafting and sketching with emphasis on lettering techniques, map reading, earthwork cross-sections, survey platting and plan detailing. Drawings are developed using manual and computer-aided drafting techniques. Prerequisite: DDT 183. 3 credit hours.

**DDT 130 Practical Drafting for the HVAC Trades.** This course provides an introduction into basic drafting principles and modern shop practices related to the heating, ventilation, and air conditioning systems. 3 credit hours.

**DDT 135 Introductory Drafting Fundamentals.** This course is designed to develop the basic skills required for visualizing and interpreting industrial drawings. 3 credit hours.

**DDT 150 Fundamentals of Drafting.** Beginning course stressing care and use of drafting instruments, lettering techniques, drafting terms, ANSI specification, manual drawing, shape descriptions, geometric construction and multiview projection. 3 credit hours.

**DDT 151 Mechanical Drafting with Dimensioning and Tolerancing.** Applying dimensions and tolerances to drawings of machine parts using the proper technique of dimensioning following ANSI specifications. Prerequisites: DDT 153 and DDT 183. 3 credit hours.

**DDT 153 Industrial Graphics.** Pictorial representations using standard types of projection, emphasizing sketching, proper technical illustration and dimensioning. Prerequisite: DDT 150. 3 credit hours.

**DDT 154 Industrial Design.** Applying the study of threads, fasteners, sections and descriptive geometry to machine working drawings; including CAD applications in detailing. Prerequisite: DDT 151. 3 credit hours.

**DDT 163 Design Drafting Internship.** The drafting internship is a planned work experience comprised of 420 hours of paid on-the-job training in a drafting or drafting related field requiring the student to perform a variety of tasks. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of activities (tasks performed). While the internship is not a program requirement for the Associate of Applied Science Degree, the student gains valuable practical experience in the workplace. Prerequisites: DDT 150, DDT 151, DDT 153, DDT 154, DDT 183, and DDT 184 with a grade of “C” or better and Department Chair approval. 6 credit hours.

**DDT 183 Fundamentals of Computer Aided Drafting (CAD).** An introduction to CAD graphic commands and applying the basic applications in producing drawings. Fundamentals in using the drawing, editing, and dimensioning commands for two-dimensional drawings. 3 credit hours.

**DDT 184 Advanced Applications of Computer Aided Drafting and Design (CADD).** Advanced applications in using CAD in the mechanical field in dimensioning and tolerancing including GDT, and also use of blocks and attributes. Three dimensional modeling with layout in paper space and extracting of orthographic views. Prerequisites: DDT 153 and DDT 183. 3 credit hours.



**DDT 250 Residential Architectural Drafting.** Fundamentals of architectural terms as applied in construction. Techniques in designing residential buildings. Prerequisites: DDT 154 and DDT 184. 3 credit hours.

**DDT 252 Structural Steel Drafting.** Structural steel terms and steel members used in different types of steel buildings. The study of American Institute of Steel Construction Steel Detailing Manual. Prerequisite: DDT 253. 3 credit hours.

**DDT 253 Residential Architectural Detailing and Design.** Planning and designing floor plans, elevations, foundations, details and sections of buildings. Dimensioning techniques will be emphasized for accuracy. Prerequisite: DDT 250. 3 credit hours.

**DDT 254 Structural Detailing and Design.** The application in detailing of concrete construction. The use of Portland Cement Association detailing manuals to create plans and detail drawings of pour-in-place and precast concrete. Prerequisite: DDT 252. 3 credit hours.

**DDT 299 Special Topics in Design Drafting Technology.** Special Topics in Design Drafting Technology (DDT) may include instruction on topics not covered in other DDT courses. Topics covered in other DDT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## **ELECTRIC POWER GENERATION TECHNOLOGY**

**47.0101**

*(Associate of Applied Science Degree)*

As a society we take for granted that our electric power will run 24 hours a day, 7 days a week so that we can have the food, clothing, homes, medical care, electronic devices and personal amenities we depend on. That's why medical facilities, financial institutions, power companies, grocery stores, and even residential homes are now using backup generators to maintain electric power in the event of a power outage. Power generators are also used to deliver temporary electric power to oil fields, chemical plants, mining sites, construction sites, movie sets, and shipping yards. As a result the demand for power generators has dramatically risen based on society's significant dependence on electric power.

The Electric Power Generation Technology's (EPG) curriculum provides students with the opportunity to develop the skills needed to install, maintain, diagnose and service on-site power generation units. Electric power generators are used in a number of different scenarios including emergency standby power, prime power, co-generational power, or peak power. The program provides instruction in basic electricity, prime movers, motors, switchgears and governors. Students are exposed to the fundamentals of the electric grid and the impact of generators supporting the grid. The EPG program also contributes to the green economy by teaching students to work with solar and wind power equipment. Additionally, students are taught about different types of alternative fuels and their impacts on the environment. Biodegradable solvents and other products are used to help reduce water, air, and soil contamination. The Electric Power Generation Technology program is accredited by the Equipment & Engine Training Council (EETC) in Electrical and Generators. All students will have the opportunity to become certified through the EETC.

Employment opportunities for EPG graduates include but are not limited to transportation and power generation technicians, technical sales consultant, industrial maintenance technician, field service technician, sales representative, or service manager.

Enrollment in the EPG program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline. Students may be sponsored by an EPG dealer or company or other companies participating in alternative energy.

EPG is a fast-paced accelerated program designed to produce highly skilled alternative energy technicians. The EPG Associate of Applied Science degree is a highly specialized technical degree which requires entering students to hold an Associate of Applied Science degree or the equivalent in a mechanical, electrical or electronic field. The EPG Less than One Semester Certificate is designed for those who have gained fundamental mechanical, electrical, or electronic skills through other means such as industry experience or college studies and are interested in upgrading their skills or changing careers.

It is a graduation requirement that a grade of "C" or better must be maintained in all Electric Power Generation Technology (EPG) courses.



**Program Mission**

The mission of the Electric Power Generation Technology program is to provide students with the opportunity to develop the technical and interpersonal skills necessary to succeed in today’s power generation and alternative energy fields.

**Program Goals**

The goals of the program are to provide opportunities for students to develop and demonstrate:

- Mechanical and electrical knowledge and skills needed to install, maintain, and service electric power generators.
- Mechanical and electrical knowledge and skills needed to install, maintain, and service wind generators.
- Mechanical and electrical knowledge and skills needed to install, maintain, and service solar energy devices.
- Mechanical and electrical knowledge and skills needed to install, maintain, and service multi and alternative fueled generators.
- Critical thinking skills used in problem solving.
- Oral and written communication skills needed in the power generation and alternative energy fields.

**CORE CURRICULUM**

			<b>Credit Hours</b>
EPG	105	Basic Tooling and Safety	2
EPG	115	Basic Engine Fundamentals	3
EPG	125	Engine Systems Fundamentals	3
EPG	130	Generator, Alternator, and Motor Fundamentals	2
EPG	205	Generator Application and Installation	2
EPG	215	AC/DC Fundamentals and Motor Controls	3
EPG	235	Instruments, Controls, and Protection	2
EPG	245	Green Energy Fundamentals	2
EPG	255	Troubleshooting and Diagnostics	2
<b>SUB-TOTAL</b>			<b>21</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

Electives	Approved electives in electric power generation related topics such as electrical, mechanical, and electronic technologies and skills. Credits earned in prior degrees will be considered.	20
<b>SUB-TOTAL</b>		<b>20</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Electric Power Generation Technology (EPG) program for students to earn a grade of “C” or better in all “Electric Power Generation Technology (EPG)” courses.

<b>PROGRAM TOTAL</b>	<b>61</b>
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**ELECTRIC POWER GENERATION TECHNOLOGY**

**47.0101**

*(Less than One Semester Certificate)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
EPG	105	Basic Tooling and Safety	2
EPG	115	Basic Engine Fundamentals	3
EPG	125	Engine Systems Fundamentals	3
EPG	130	Generator, Alternator, and Motor Fundamentals	2
EPG	205	Generator Application and Installation	2
EPG	215	AC/DC Fundamentals and Motor Controls	3
EPG	235	Instruments, Controls, and Protection	2
EPG	245	Green Energy Fundamentals	2
EPG	255	Troubleshooting and Diagnostics	2
<b>SUB-TOTAL</b>			<b>21</b>

**GRADUATION REQUIREMENT**

It is a graduation requirement of the Electric Power Generation Technology (EPG) program for students to earn a grade of “C” or better in all “Electric Power Generation Technology (EPG)” courses.

**PROGRAM TOTAL**

**21**

**EPG 105 Basic Tooling and Safety.** This course teaches the basic tooling that will be used in the generator service field. The course will also cover hazards associated with electric power generation, safety rules, safe work practices, OSHA rules, regulations associated with this industry, and the reporting procedures and penalties that pertain to these regulations. 2 credit hours.

**EPG 115 Basic Engine Fundamentals.** This course teaches the basic core components of an engine. Also covered will be the theory, construction, and operation of the internal combustion engine. Emphasis is put on proper diagnosis, failure analysis, and service procedures according to manufacturers’ specifications. 3 credit hours.

**EPG 125 Engine Systems Fundamentals.** This course teaches the engine systems that comprise the complete unit. The following systems will be covered: ignition, starting, charging, fuel, exhaust, coolant, and governor. Also covered will be the steps in troubleshooting and diagnosing prime movers and their related components. 3 credit hours.

**EPG 130 Generator, Alternator, and Motor Fundamentals.** This course teaches the construction and operation of single and 3-phase generators, alternators, and motors. Also covered in this course are various load types, special applications, temperature, related components, and environmental concerns. 2 credit hours.

**EPG 205 Generator Application and Installation.** This course teaches the different systems that are important when installing a generator. Systems covered include: air, cooling, exhaust, fuel, starting, mounting, ventilation, load, and noise. Room design and sizing are considered. 2 credit hours.

**EPG 215 AC/DC Fundamentals and Motor Controls.** This course teaches the fundamentals of AC/DC and electro-magnetic theory. Coils, relays, solenoids, contactors, and motor starters are also covered. Schematics are used to understand the functions of a switchgear control and transfer switch and how they are controlled. 3 credit hours.



**EPG 235 Instruments, Controls, and Protection.** This course teaches instruments, controls, and protection of the prime mover and the generator. The operation and troubleshooting of gauges, breakers, relays, controllers, sensors, and switches are also covered. 2 credit hours.

**EPG 245 Green Energy Fundamentals.** This course teaches the fundamentals of green energy solutions in the electric power generation industry with emphasis on wind and solar energy. 2 credit hours.

**EPG 255 Troubleshooting and Diagnostics.** This course teaches the theory and skills of troubleshooting and diagnosis. These skills will be used to effectively locate and repair failures of the prime mover, generator, and control systems. 2 credit hours.

**EPG 299 Special Topics in Electric Power Generation Technology.** Special Topics in Electric Power Generation Technology (EPG) may include instruction on topics not covered in other EPG courses. Topics covered in other EPG courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## **ELECTRICAL DISTRIBUTION SYSTEMS**

**46.0303**

*(Associate of Applied Science Degree)*

The Electrical Distribution Systems program prepares individuals to climb wood pole structures, build and maintain electrical distribution systems (both overhead and underground), use safe work practices, administer first aid, and perform pole top rescue. Students also receive a strong foundation in math, communication, and critical thinking skills. The students are required to participate in an approved internship. This field has a high demand for experienced individuals resulting in relatively high pay. Students who graduate from this program have attained a basic understanding of distribution systems, which prepares students for employment in the field with an advanced apprenticeship rating.

Enrollment in the Electrical Distribution Systems program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

The Electrical Distribution Systems program at Linn State Technical College is taught on a full-time basis and provides extensive hands-on training in small classes taught by faculty who have worked in this related field. The Electrical Distribution Systems program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

Courses in climbing skills, pole framing, equipment operation, transformers and transformer theory, and general studies will develop the competencies required of the electrical line worker. All students become CPR and First Aid certified. Safety and electrical code requirements are stressed in all classes.

The Electrical Distribution Systems program contributes to the green economy by recycling scrap material and using recycled products such as wood chips from the Three Rivers Electric Cooperative's right-of-way tree trimming program in the outdoor pole climbing lab.

Due to industry employment requirements, to enroll and remain enrolled in the Electrical Distribution Systems program, students are required to receive and maintain at all times a current, valid Class A Commercial Driver's License (CDL). The CDL training and licensing require students to: 1) maintain a driving record that is eligible for a Missouri Class A CDL, 2) obtain a complete, current, and valid Medical Examination Report and Certificate for Commercial Driver Fitness Determination, and 3) successfully pass drug screen(s).

A grade of "C" (70%) must be maintained in all courses, including the internship, as part of the graduation requirement; due to state licensing requirements, students must earn a grade of "B" or better in the CDL classes. The attendance policy for Electrical Distribution Systems students is stricter than the college-wide policy. Students should be aware that in addition, they may also be subject to drug testing as a safety precaution.

### **Program Mission**

The mission of the Electrical Distribution Systems program is to provide the students the knowledge and technical skills required to succeed in the electrical distribution industry as an above average entry-level employee.



**Program Goals**

The goals of the program are to provide students the opportunity to:

- Demonstrate effective communication skills both verbally and written.
- Develop skills necessary for computing of mathematics for the calculation of electrical loads, weights, and measures.
- Develop industry-wide safe work practices per American Public Power Association guidelines.
- Develop the necessary skills to gain entry-level employment in the electrical field.

**CORE CURRICULUM**

			<b>Credit Hours</b>
EDS	105	Electrical Distribution Systems	2
EDS	195	Setting and Removing Poles	3
EDS	202	Safety and Accident Prevention	3
EDS	205	Climbing Skills	2
EDS	210	Pole Framing and Construction Specifications	3
EDS	220	Equipment Operation	3
EDS	235	Utility Internship	8
EDS	237	Transformer Theory and Installation	5
EDS	241	Conductor Installation, Service and Metering	4
EDS	251	Rubber Gloving and Underground Distribution	4
EDS	272	Fusing, Substation, and Voltage Regulation Equipment	2
<b>SUB-TOTAL</b>			<b>39</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
	Must Include:	PHY 101/102 College Physics	4
<b>SUB-TOTAL</b>			<b>19</b>

**PROGRAM REQUIREMENTS**

HEO	151	Basic Commercial Driver License	1
HEO	152	Basic Commercial Driver License Lab	1
IEL	117	Circuitry Fundamentals w/Lab	4
EMS	120	Trigonometry for Industrial Electricity	3
OR			
MAT	121	Trigonometry	
COM	201	Occupational Communication	3
OR			
COM	211	Technical Writing	
<b>SUB-TOTAL</b>			<b>12</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Electrical Distribution Systems (EDS) program for students to: 1) earn a grade of “C” or better in all courses; due to state licensing requirements, students must earn a grade of “B” or better in the CDL classes; and 2) earn CPR and First Aid certifications.

<b>PROGRAM TOTAL</b>			<b>71</b>
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**EDS 105 Electrical Distribution Systems**. This course will give the student an overview of the types of electrical distribution systems in use. It is a comprehensive class with real world applications, operations, power conversion, control, measurement and quality issues. Transmission and distribution structures and the power grid will also be covered. 2 credit hours.

**EDS 195 Setting and Removing Poles**. The student will learn the basic principles in setting and removing poles. There will be an emphasis on the proper use of building materials. Temporary pole supports, rigging, and worksite hazard protection will also be covered. Prerequisites: EDS 105 and EDS 202 with a grade of “C” or better. 3 credit hours.

**EDS 202 Safety and Accident Prevention**. This course teaches the hazards associated with electrical distribution systems. The student will be able to implement the proper climbing techniques, safety rules, and safe work practices from the American Public Power Association Safety Manual. The student will learn Occupational Safety and Health Administration (OSHA) rules and regulations associated with this industry, reporting requirements, and the penalties that pertain to these regulations. 3 credit hours.

**EDS 205 Climbing Skills**. The student will gain the knowledge of the proper care of climbing tools, and the mastering of climbing wood structures. Upon completion of this course the student will also be able to determine the proper aspects of pole inspection, and be able to recognize the hazards of climbing. Successful completion of timed pole top rescue in two different methods. An introduction to aerial pole framing is included in this discipline. Prerequisites: EDS 105 and EDS 202 with a grade of “C” or better. 2 credit hours.

**EDS 210 Pole Framing and Construction Specifications**. This course will give the student a working knowledge of the Rural Utilities Service line construction specifications set forth by the Department of Agriculture. This will include the aspects of 12,500; 14,400; and 34,500 volt construction. The student will be able to recognize the different types of materials used for the different types of construction by sight and definition. The student will be required to demonstrate working specification knowledge both in aerial and ground situations as well as installation and repair of conductors, guy assemblies, cross arms, and insulators. They will also be introduced to the different sizes and types of overhead and underground conductors. Basic line staking principles and National Electric Safety Code clearances will be included. Prerequisites: EDS 105 and EDS 202 with a grade of “C” or better. 3 credit hours.

**EDS 220 Equipment Operation**. The student will learn the various operations of different digger/derrick and bucket/basket aerial platform trucks used in the construction of electrical distribution systems. The student will be familiarized with the basic operation of trencher/backhoe equipment. This class also covers units on mobile hydraulic systems, vehicle maintenance and inspection, safety rules, rigging and lifting capacities, vehicle grounding practices, and the hands-on operation of digger/derrick and bucket/basket aerial platform trucks. Prerequisites: EDS 105 and EDS 202 with a grade of “C” or better. 3 credit hours.

**EDS 235 Utility Internship**. This will provide the student with a day-to-day knowledge of a working utility. The student will be required to complete at least two written assignments and fill out the required forms provided by the instructor. The instructor will check with the student on the jobsite to be sure that the requirements for the internship are being met. This course will be completed between the first and second years of the Electrical Distribution Systems program. Prerequisites: EDS 195, EDS 205, EDS 210, and EDS 220 with a grade of “C” or better, first aid and CPR certifications, and instructor’s permission based on valid Class A Commercial Driver’s License (CDL). 8 credit hours.

**EDS 237 Transformer Theory and Installation**. The student will gain a thorough knowledge of transformer theory and installation. Single-phase and three-phase configurations with different types of connections will be included. Other units covered will include over voltage and over current protection, equipment grounding, cutout protection, proper cover-up techniques, lightning arrestor application and installation, Rural Utilities Service specifications and pole framing. Basic troubleshooting practices and current and potential transformers will also be included. Prerequisites: EDS 195, EDS 205, EDS 210, and EDS 220 with a grade of “C” or better. 5 credit hours.



**EDS 241 Conductor Installation, Service and Metering.** The student will gain extensive knowledge of single- and three-phase watt-hour meters; meter locations; and the different types of copper and aluminum conductors. The student will also gain practical experience in the sizing, installation, stringing, sagging, dead-ending, and splicing of service conductors. The student will also be exposed to the construction of meter loops and poles; instrument metering; temporary meter locations; compression sleeves; connectors and tools including strap hoists, chain hoists, sag charts and tables, pulling grips and mechanical jumpers. Also included are disciplines on meter tampering, power theft, proper grounding techniques and safe work practices. Prerequisites: EDS 195, EDS 205, EDS 210, and EDS 220 with a grade of “C” or better. 4 credit hours.

**EDS 251 Rubber Gloving and Underground Distribution.** The student will obtain basic discipline in the methods of working on energized lines with rubber gloves and rubber sleeves from an insulated aerial platform in a safe and efficient manner. The student will be exposed to the care and well-being of soft and hard shell rubber goods and their application. The student will also receive instruction on personal protective equipment, hot-line tools, live-line maintenance and will also review the safe operation of aerial platforms and grounding practices. Additionally, the student will gain working knowledge of URD systems. The student will receive practical experience in primary and secondary cables, installation of 200 and 600 amp elbows, splices, lightening arrestors and overhead termination’s. The installation of single- and three-phase padmount transformers will also be covered. The requirements of shoring and sloping of trenches required by the safe work practices will be discussed. Troubleshooting of primary and secondary cable fault locating and associated safe work practices and procedures may be covered. Prerequisites: EDS 195, EDS 205, EDS 210, and EDS 220 with a grade of “C” or better. 4 credit hours.

**EDS 272 Fusing, Substation, and Voltage Regulation Equipment.** The student will be introduced to the different types and methods of system coordination, substations, capacitors, voltage regulators and auto-boosters. A working knowledge of oil reclosures, sectionalizers and the application of fuses will also be gained. Practical experience will be gained in the grounding, inspection, maintenance and operation of basic substations. The course will also introduce single- and three-phase pole mount reclosures, gang operated air break and load break switches, and substation fuses and reclosures. Prerequisites: EDS 195, EDS 205, EDS 210, and EDS 220 with a grade of “C” or better. 2 credit hours.

**EDS 299 Special Topics in Electrical Distribution Systems.** Special Topics in Electrical Distribution Systems (EDS) may include instruction on topics not covered in other EDS courses. Topics covered in other EDS courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## **ELECTRONICS ENGINEERING TECHNOLOGY**

### **GENERAL OPTION**

### **BIOMEDICAL ENGINEERING TECHNOLOGY OPTION**

**15.0303**

*(Associate of Applied Science Degree)*

Experts predict that the “new millennium” will continue to be dominated by unprecedented advancements in knowledge and science, largely attributable to the accelerated growth in electronics technology. As the electronic systems and equipment that power our personal and professional lives become more pervasive and integral to our existence, the expertise of the electronics technologist is increasingly vital.

The Electronics Engineering Technology program provides graduates with a diverse knowledge base and a comprehensive understanding of the principles of electricity, microcomputers, communications and industrial electronics. Graduates have the ability to apply these concepts in solving technical and scientific problems. Emphasis on practical skills and state-of-the-art applications ensure immediate applicability to the needs of industry.

Students will take the Society of Manufacturing Engineers (SME) electrical/electronic engineering technology (EET) assessment exam. Once the SME-EET certificate is earned, students are then eligible for additional industry-recognized assessment exams.

The Electronics Engineering Technology program contributes to the green economy by recycling and reusing motors and other electronic equipment components for student projects.

Students enrolling in the Electronics Engineering Technology program have two degree options to choose from:

#### Electronics Engineering Technology General Option

The Electronics Engineering Technology General Option focuses on the fundamentals of the technology driving today’s systems, including computer systems, telecommunications, networks, wireless, controls and instrumentation. Graduates have a broad knowledge base that qualifies them for challenging career-entry positions in the dynamic electronics fields. The Electronics Engineering Technology General Option is accredited by the Technology Accreditation Commission (TAC) of ABET and the Federal Aviation Administration’s Air Traffic Organization, Technical Operations, Collegiate Training Initiative.

#### Electronics Engineering Technology Biomedical Engineering Technology Option

The Electronics Engineering Technology Biomedical Engineering Technology Option provides students with an intensive, hands-on experience that concentrates on general biomedical equipment with an introduction to diagnostic imaging. Students in this option will also become qualified to take the Association for the Advancement of Medical Instrumentation (AAMI) certification exam.



**Program Mission**

The mission of the Electronics Engineering Technology program is to provide our students with the knowledge, skills, and attitudes required for a challenging and successful career in the field of electronics through an intensive program that focuses on problem solving and critical thinking.

**Program Goals**

The goals of the program are to:

- Assure that the student has the opportunity to demonstrate effective communication skills including teamwork and interpersonal skills.
- Assure that the student has the opportunity to demonstrate proper analysis and troubleshooting/problem solving techniques.
- Assure that the student has the opportunity to demonstrate the technical knowledge, understanding and rationale for all applied tasks associated with all major subject areas.
- Assure that the student has the opportunity to demonstrate the ability to research and utilize component data using specification sheets and reference manuals.
- Assure that the student has the opportunity to demonstrate skills in the repair or upgrade of advanced electronics systems.
- Assure that the student has the opportunity to demonstrate a professional attitude toward the emerging electronics industry including continuing education.

**CORE CURRICULUM**

			<b>Credit Hours</b>
EET	125	Digital Electronics w/Lab	4
EET	126	DC/AC Circuit Analysis	6
EET	127	DC/AC Circuit Analysis Lab	2
EET	130	Semiconductor Devices and Analog Circuits	6
EET	131	Semiconductor Devices and Analog Circuits Lab	2
EET	140	Microcomputer Hardware, Operation and Repair	4
EET	210	Industrial Electronics w/Lab	5
EET	237	Electronic Telecommunications w/Lab	5
COM	211	Technical Writing	3
<b>Optional:</b>			
EET	200	Prep for Electronics Technicians Certification (Optional)	(1)
EET	150	Lasers and Optics (Optional)	(3)
EET	155	Fiber Optic Principles (Optional)	(3)
<b>SUB-TOTAL</b>			<b>37-44</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)		19
Must Include:	MAT 122 Elements of Calculus	3
	PHY 201 General Physics	5
<b>SUB-TOTAL</b>		<b>20</b>

**PROGRAM REQUIREMENTS**

			<b>General Option</b>
EET	214	Programmable Controllers	4
EET	230	Microcontrollers and Embedded Systems	4
EET	240	Computer Integrated Manufacturing w/Lab	4
<b>SUB-TOTAL</b>			<b>12</b>

**OR**



		<b>Biomedical Engineering Technology Option</b>	
EET	105	Human Anatomy and Physiology as applied to Biomedical Instrumentation	3
EET	110	Medical Terminology	2
EET	223	Biomedical Instrumentation Systems	6
EET	225	Diagnostic Imaging	3
<b>Optional:</b>			
EET	170	Biomedical Engineering Technology Internship (Optional)	(4)
		<b>SUB-TOTAL</b>	<b>14-18</b>
		<b>GRADUATION REQUIREMENT</b>	
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		<b>PROGRAM TOTAL</b>	<b>70-83</b>

**EET 105** Human Anatomy and Physiology as applied to Biomedical Instrumentation. This course is an overview of the body systems, structures and functions. Emphasis is placed on the nervous, cardiovascular and respiratory systems. This course will introduce students to therapeutic and diagnostic biomedical instrumentation as it relates to the body systems. 3 credit hours.

**EET 110** Medical Terminology. This comprehensive introduction to medical terminology is organized by body system and specialty areas of practice. Word building rules assist in understanding the basis for combining word elements; and medical terms are broken down into component parts each time a new term is introduced. The course is designed to help the student acquire a working medical vocabulary to spell, use, and define medical terms. 2 credit hours.

**EET 120** Basic Electricity and Electronics. This course introduces the fundamental concepts of electricity/electronics and test equipment to non-electrical/electronic majors. Topics include basic DC and AC principles (voltage, current, resistance, and impedance); components (resistors, inductors, capacitors, and semi-conductors); power; and the operation of test equipment. Upon completion of this course the student will be able to construct and analyze/troubleshoot basic DC and AC circuits (series, parallel, and series-parallel). 3 credit hours.

**EET 125** Digital Electronics w/Lab. Logic design, combinational logic circuits, sequential logic circuits, timing concepts, digital arithmetic operations and circuits, integrated circuit logic families, MSI/LSI logic circuits, memory devices and circuits, microprocessor architecture, instruction types and addressing modes and memory organization. Also includes a laboratory course with experiments designed to support this course. 4 credit hours.

**EET 126** DC/AC Circuit Analysis. This course teaches theoretical and practical analysis of electrical physics, conductors, semiconductors, and insulators. Topics include resistance, capacitance, inductance, application of laws and theorems, conversion of electrical units, power, and energy. Also included is theoretical analysis of DC and AC series and parallel combinational circuits, voltage dividers, magnetism, and electromagnetism. Other topics include: test equipment and meter scales, waveforms and waveform analysis, vector analysis, reactive circuits, and filter construction and application. Concurrent: EET 127. 6 credit hours.

**EET 127** DC/AC Circuit Analysis Lab. This laboratory is designed to teach theory of diagnosis and use of electronic instruments in conjunction with electrical safety. It is also designed to provide practical experience in the construction, analysis, and troubleshooting of basic electronic circuits. Concurrent: EET 126. 2 credit hours.



**EET 130 Semiconductor Devices and Analog Circuits.** This course teaches the analysis and design of circuits, utilizing both discrete and integrated circuit components, are implemented into various system applications. Topics include: electronic conduction in conductors and semiconductors, the pn junction, diodes, diode circuits, special purpose diodes, optoelectronic devices, bipolar transistors, transistor fundamentals, transistor biasing, AC models, amplifiers, field effect transistors (FET), FET circuits, thyristors, operational amplifiers, amplifier frequency effects, negative feedback, linear op-amp circuits, oscillators and regulated power supplies. Prerequisite: EET 126. Concurrent: EET 131. 6 credit hours.

**EET 131 Semiconductor Devices and Analog Circuits Lab.** This laboratory is designed to provide practical experience in the construction, analysis and troubleshooting of electronic devices. Breadboarding of circuits utilizing electronic devices will be performed. Prerequisite: EET 127. Concurrent: EET 130. 2 credit hours.

**EET 140 Microcomputer Hardware, Operation and Repair.** This course teaches: operating systems; motherboards; central processing units (CPUs); power supplies; input and output devices; magnetic storage devices; laptops; troubleshooting, repair, and introduction to networking. Also includes laboratory work with experiments designed to support course objectives. Prerequisite: EET 125. 4 credit hours.

**EET 150 Lasers and Optics.** This course teaches the fundamentals of lasers and optics. It covers the nature and properties of light, optical handling and positioning, light sources, laser safety, basic geometric optics, basic physical optics, and principles of laser operation. Prerequisites: MAT 115 or equivalent and EET 130 or equivalent. 3 credit hours.

**EET 155 Fiber Optic Principles.** This course teaches the principles of fiber optics, fiber optic networks, optical fiber cable types, estimating and bidding for fiber optic installation, specifying fiber optic cable, and understanding the guidelines for fiber optic design and installation. The course also covers the principles of fiber optic hardware to include connectors, splices, tools, and test equipment. Planning the fiber installation, fiber optic safety, pulling the fiber, and fiber restoration are also covered. 3 credit hours.

**EET 170 Biomedical Engineering Technology Internship.** The internship is an optional work experience in a biomedical facility under the supervision of an experienced biomedical engineering technician. The student will assist in the performance of safety inspections, preventive maintenance, repairs and calibration of various medical equipment. Prerequisite: EET 105. 4 credit hours.

**EET 200 Prep for Electronics Technicians Certification.** This course provides review and study of terms, components, basic electrical/electronic units and symbols, basic circuit configurations and applications, and test equipment used for the testing and analysis of electrical/electronic circuits. This review and study prepares the student to take the Associate level International Society of Certified Electronics Technician (ISCET) Test at the end of the course. Prerequisites: EET 125, EET 126, EET 127 and EET 210. 1 credit hour.

**EET 210 Industrial Electronics w/Lab.** This course includes operational amplifiers for industrial applications, linear integrated circuits for industrial applications, A/D and D/A conversion, DC motors and generators, industrial control devices and circuits, power control devices and circuits, optical electronics control devices, temperature and humidity transducers, industrial process control applications and circuits, pulse modulation techniques, data acquisition, industrial telemetry and data communication, sequential process control and control logic and programmable controllers. Also includes a laboratory course with experiments designed to support this course. Prerequisites: EET 125, EET 130 and EET 131. 5 credit hours.

**EET 214 Programmable Controllers.** Course includes the hardware configuration, I/O modules, memory organizations, and instruction sets of several different programmable controllers. Students study ladder logic and apply it to several industrial control applications. Prerequisite: EET 125. 4 credit hours.



**EET 223 Biomedical Instrumentation Systems.** Topics taught in this course are sensors, transducers, and electronic circuits associated with biomedical instrumentation. Operation, maintenance, diagnostics and calibration of various types of biomedical instrumentation will be performed. Origination of biopotentials will be discussed. Electrodes and circuitry used to record electroencephalograms, electromyography, and electrocardiograms will be analyzed. This course includes laboratory work to reinforce topics covered in the lectures. Prerequisites: EET 105, EET 110, EET 140 and EET 210. 6 credit hours.

**EET 225 Diagnostic Imaging.** This course covers the theory of diagnostic imaging including x-ray, computer aided tomography, nuclear imaging and ultrasound. Components and safety of nuclear imaging systems are included. Safety aspects of x-ray are also taught. Prerequisites: EET 125, EET 130 and EET 131. 3 credit hours.

**EET 230 Microcontrollers and Embedded Systems.** This course teaches system-level design of embedded systems with a top-down design approach. Assembly language programming skills are developed using editor/assembler software. The lectures teach fundamental concepts, theory and design principles of embedded systems, while the labs provide students the opportunities to apply the learned concepts. Topics will include: basic concepts of embedded control systems and applications of microcontrollers, basics of structured programming using assembly language, architecture of the microcontroller, interfacing with off-chip peripheral hardware, and microcontroller programming techniques. Prerequisites: EET 125 and EET 140 with a grade of “C” or better. 4 credit hours.

**EET 237 Electronic Telecommunications w/Lab.** A course designed to study all the relevant aspects of communications systems. Topics include signals and their spectra, noise, amplitude, single side band, frequency, angle and pulse modulation, transmission and reception, communications techniques, digital and data communications, digital-to-analog and analog-to-digital conversions, radio telemetry, transmission lines, antennas, antenna wave propagation, LASER and fiber optic techniques and television theory. Also includes a laboratory course where digital and analog communications systems troubleshooting procedures are emphasized. Prerequisite: EET 130 and EET 131. 5 credit hours.

**EET 240 Computer Integrated Manufacturing w/Lab.** A comprehensive technical survey of the important topics in production automation and related systems. Topics include flow line production, numerical control, industrial robotics, material handling, group technology, flexible manufacturing systems, automated inspection, process control, and computer integrated manufacturing (CIM). Students design and model a CIM system. Skills in system design and layout, controller design, hardware interfacing, control and timing implementation, and software interfacing are developed. Prerequisites: EET 210 and EET 140. 4 credit hours.

**EET 299 Special Topics in Electronics Engineering Technology.** Special Topics in Electronics Engineering Technology (EET) may include instruction on topics not covered in other EET courses. Topics covered in other EET courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## HEATING, VENTILATION, & AIR CONDITIONING TECHNOLOGY

**47.0201**

*(Associate of Applied Science Degree)*

The Heating, Ventilation, & Air Conditioning Technology program is a center of excellence for teaching alternative energy technicians to install, service, and repair heating, refrigeration and air conditioning systems. Basic heating, refrigeration and air conditioning theory are enhanced with extensive hands-on training in laboratories and on in-service equipment. Comprehensive coverage is given to electrical motors, controls and wiring and systems diagnosis and repairs.

The Heating, Ventilation, & Air Conditioning Technology (HVT) program began contributing to the green economy in 1973 by teaching students to install and maintain high efficiency furnaces, air conditioning units, air source heat pumps, and geothermal ground source heat pumps that save energy in commercial and residential settings. Instruction on solar energy equipment is also included in the program. The HVT program also recycles cooking oil to burn in fuel oil furnaces, uses setback thermostats, recycles refrigerant, and reuses equipment components and parts for training.

This program has provided special emphasis in geothermal technology for over 35 years. Geothermal energy production is a \$1.5 billion industry, which generates electricity or provides heat for direct applications including aquaculture, crop drying, and district heating or for use in heat pumps to heat and cool buildings. Students use real world geothermal equipment in laboratory classes where they learn to install, maintain, and repair geothermal systems.

Presently, 95% of all main campus buildings operate with geothermal systems to gain energy efficiencies, reduce harmful emissions, save taxpayer dollars, and provide a geothermal learning laboratory.

Graduates may be employed in the installation, maintenance, repair, or sales of residential or commercial HVAC systems or operate their own businesses. Commercial applications may include grocery stores, health care facilities, hotels and resorts, manufacturing operations, educational institutions, and other operations.

The Heating, Ventilation, & Air Conditioning Technology program has three national accreditations: HVAC Excellence, the Partnership for Air Conditioning, Heating, Refrigeration Accreditation (PAHRA), and the Association of Technology, Management, and Applied Engineering (ATMAE).

Students are required to join the Refrigeration Service Engineers Society (RSES), a nationally recognized educational certification agency. RSES training materials are used in the classroom, and students can become certified in four RSES areas if they pass the required examinations. Many contractors are RSES members and seek employees with certification.

Enrollment in the Heating, Ventilation, & Air Conditioning Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.



**Program Mission**

The mission of the Heating, Ventilation, & Air Conditioning Technology program is to prepare students to install, service and repair refrigeration and air conditioning systems.

**Program Goals**

The goals of the program are to:

- Ensure the student gains the skills needed for analytic and problem solving in the HVAC/R industry.
- Ensure the student gains knowledge in servicing and repairing heating, air conditioning, and refrigeration equipment.
- Ensure the student demonstrates effective communication and interpersonal skills.
- Ensure the student has knowledge of safety standards as related to the HVAC/R field.

**CORE CURRICULUM**

			<b>Credit Hours</b>
HVT	151	Fundamentals of Refrigeration, Air Conditioning, and Introduction to Domestic Refrigeration	6
HVT	155	Electricity Fundamentals	4
HVT	152	Domestic and Commercial Refrigeration w/Lab	6
HVT	123	Electrical Wiring (Residential)	3
HVT	124	Electrical Wiring (Lab)	2
HVT	255	Internship (Fourteen-week)	8
HVT	251	Residential and Commercial Air Conditioning	6
HVT	261	Residential and Commercial Motors & Controls	3
HVT	270	Sheet Metal Lecture/Lab	2
HVT	252	Residential and Commercial Heating & A/C w/ Lab	6
HVT	262	System Diagnosis and Repair	3
		<b>SUB-TOTAL</b>	<b>49</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
		<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENT**

DDT	130	Practical Drafting for the HVAC Trades	3
		<b>SUB-TOTAL</b>	<b>3</b>

**GRADUATION REQUIREMENT**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

**PROGRAM TOTAL** **72**

**HVT 123 Electrical Wiring (Residential).** This classroom proven course is updated to the latest National Electrical Code (NEC), and new materials are covered. Throughout the course the student is asked to draw wiring diagrams, make electrical calculations, refer to plan specifications and use the latest NEC. The student completes work sheets on wiring layout, room for room, topic by topic and will completely wire a typical single family residence. Prerequisite: HVT 155 with a grade of “C” or better. 3 credit hours.

**HVT 124 Electrical Wiring (Lab).** Hands-on shop course in residential wiring. Working with the National Electrical Code (NEC) book and learning manipulative skills in house wiring. This shop course supports lecture course HVT 123. Prerequisite: HVT 155 with a grade of “C” or better. 2 credit hours.



**HVT 151 Fundamentals of Refrigeration, Air Conditioning and Introduction to Domestic Refrigeration.** A lecture and demonstration/laboratory course covering theory of refrigeration and air conditioning. Basic psychrometry, heat transfer and thermodynamics, and fundamental refrigeration and air conditioning systems are included. The selection and safe handling of tools and materials, forming, fitting, brazing and soldering of tubing is taught. Basic instruction in the use of cleaning solvents, refrigeration oils and refrigerants. Principles of domestic refrigeration covering all components of household refrigerators. Students can earn certification from RSES, ARI and the EPA. 6 credit hours.

**HVT 152 Domestic and Commercial Refrigeration w/Lab.** Additional theory and practical applications. A lecture/demonstration/laboratory course including maintenance and service of evaporators, compressors, refrigerant control valves, electrical motors and controls, receivers and accessories. Load calculations are covered in detail. Students learn manipulative skills and procedures in the operation, maintenance, servicing, and sizing of the proper equipment. Theory and practical application of three phase motors and equipment. Prerequisites: HVT 151 and HVT 155 with a grade of “C” or better. 6 credit hours.

**HVT 155 Electricity Fundamentals.** Introductory lecture course which covers theory and application of Ohms Law. Covers resistance, capacitance, inductance, transformers, motors used for domestic applications, series, parallel circuits and other circuitry. 4 credit hours.

**HVT 251 Residential and Commercial Air Conditioning.** A lecture and demonstration/laboratory course covering all the common air cooling systems and components. Emphasis is placed upon developing the ability to install and service cooling systems, components and controls. Basic sheet metal processes, insulation selection and installation and the applications of nonmetal ducts. Methods used in sizing piping on air conditioning. Selection of equipment and its application. Prerequisites: HVT 151 and HVT 152 with a grade of “C” or better. 6 credit hours.

**HVT 252 Residential and Commercial Heating and A/C w/Lab.** A lecture and demonstration/laboratory course covering all types of heating system components. Oil, gas and electric furnaces are included with laboratory assignments designed to develop the manipulative skills and knowledge required to install, service and maintain the common central or room heating systems. The course is designed to develop a high degree of skill in the design, installation and service of commercial air conditioning systems, to develop skill in troubleshooting component parts on air conditioning applications and commercial refrigeration systems, with laboratory exercises, to develop skill in accountability of time and material spent on the job and to develop in the student proper habits including punctuality, dependability and customer relations. Prerequisite: HVT 251 with a grade of “C” or better. 6 credit hours.

**HVT 255 Internship.** Fourteen weeks of paid on-the-job training. Training is provided by skilled journeymen HVAC technicians under a training agreement. Prerequisites: HVT 151 and HVT 152 with a grade of “C” or better. 8 credit hours.

**HVT 261 Residential & Commercial Motors & Controls.** Lecture and demonstration of motor and control use in air conditioning with emphasis on types, theory and application. Step by step procedures in troubleshooting motors, controls and testing air conditioning systems. Prerequisites: HVT 123 and HVT 155 with a grade of “C” or better. 3 credit hours.

**HVT 262 Systems Diagnosis & Repair.** Step by step procedures for starting new air conditioning systems. Troubleshooting system problems, servicing and testing air conditioning systems. Prerequisites: HVT 251 and HVT 261 with a grade of “C” or better. 3 credit hours.

**HVT 270 Sheet Metal Lecture/Lab.** A lecture and laboratory course designed to give the student specific instructions on job surveys, layout, fabrications, sizing and installation of sheet metal work in the air conditioning and heating trade. Prerequisite: DDT 130 with a grade of “C” or better. 2 credit hours.



**HVT 299** Special Topics in Heating, Ventilation, & Air Conditioning Technology. Special Topics in Heating, Ventilation, & Air Conditioning Technology (HVT) may include instruction on topics not covered in other HVT courses. Topics covered in other HVT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## **HEAVY EQUIPMENT OPERATIONS**

**49.0202**

*(One-Year Certificate)*

The Heavy Equipment Operations program is designed to produce operators trained in the major classification of earth moving equipment. The program starts in the summer and runs for eleven months. Students receive extensive training in the operation of dozers, scrapers, wheel loaders, backhoes, excavators, graders, and skid steers. Classroom instruction includes units in a number of related subjects such as welding, grade operations, blueprint reading and preventive maintenance (fuel and lubricants). The Heavy Equipment Operations program is accredited by the National Center for Construction Education and Research (NCCER).

The college works with local agencies, high schools, and colleges in providing practical on-the-job experience when possible. Training, which begins in June, takes place on a 125-acre operation site. Graduates of the one-year (11 month) certificate program can expect to find entry-level employment in the following fields: county, state, and interstate highway construction, levee construction, agricultural construction, airport development, and commercial and residential construction. The total instructional hours of the certificate program are 1,350 hours of which 160 hours of instruction are in Class A Commercial Driver's License (CDL).

The applied curriculum is performed on both simulated and actual construction projects. The student will perform manual labor usually associated with these tasks (such as bolting pipe, shoveling, etc.). A course that prepares students for the Class A Commercial Driver's License (CDL) examination is included in the program. In order to enroll or continue in the Heavy Equipment Operations program students must be eligible to take the Class A Commercial Driver's License (CDL) examination and maintain eligibility until a Class A Commercial Driver's License (CDL) is obtained. If the student becomes ineligible to take the Class A Commercial Driver's License (CDL) examination or loses their Class A Commercial Driver's License (CDL) the student will not continue in the Heavy Equipment Operations program. As in industry, students will be required to pass random drug tests to enter and remain enrolled in this program.

The Heavy Equipment Operations (HEO) program contributes to the green economy by burning the college's used motor oil in a Department of Natural Resources (DNR) permitted furnace to heat the HEO building. The HEO department also recycles approximately ten tons of scrap iron annually from used undercarriages, bearings, and other equipment parts. The department recently converted all of its module exams to use Scantron cards to reduce the use of paper.

Enrollment in the Heavy Equipment Operations program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

Students will complete an internship once they have earned a grade of "C" or better in all Heavy Equipment Operations (HEO) courses and a grade of "D" or better in all General Education Requirement courses, pass the exit exam, and obtain the approval of their advisor. Students on internships are temporary employees of the company where they receive training. They are supervised by both their employers and by representatives of the college. In addition to the random drug testing described above, internship employers may also require drug testing. Students who do not pass a drug test during their internship will not continue in the Heavy Equipment Operations program.



It is a graduation requirement of the Heavy Equipment Operations (HEO) one-year certificate for students to earn a grade of “C” or better in all HEO courses; due to state licensing requirements, students must earn a grade of “B” or better in the CDL class.

**Program Mission**

The mission of the Heavy Equipment Operations program is to provide the opportunity for students to develop the technical and interpersonal skills required to be successful in the horizontal construction industry.

**Program Goals**

The goals of the program are to:

- Assure that procedures related to the operation of heavy equipment are followed in accordance with industry standards.
- Provide students with the technical competencies in the major classifications of earth moving equipment utilized at the college.
- Provide the students the opportunity to develop effective communication skills necessary to succeed in the industry.

**CORE CURRICULUM**

			<b>Credit Hours</b>
HEO	100	First Aid and Safety	1
HEO	102	Basics of Heavy Equipment Operation	1
HEO	105	Orientation to the Trade	1
HEO	106	Introduction to Heavy Equipment Operations	1
HEO	108	Introduction to OSHA Regulations	1
HEO	112	Applied Measurements In Construction	2
HEO	115	Welding	1
HEO	121	Environmental Compliance	1
HEO	134	Safety and Loss Control	3
HEO	138	Advanced Operating Techniques	1
HEO	139	Grade Operations	2
<b>SUB-TOTAL</b>			<b>15</b>

**PROGRAM REQUIREMENTS**

HEO	131	Heavy Equipment Operations Internship	3
HEO	146	Backhoe and Excavator	4
HEO	147	Dozer and Scraper	4
HEO	148	Loader	4
HEO	149	Motor Grader and Skid Steer	4
HEO	150	Commercial Driver’s License	4
<b>SUB-TOTAL</b>			<b>23</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
<b>SUB-TOTAL</b>			<b>6</b>



BUS	125	<b>GRADUATION REQUIREMENTS</b>	
		Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
<p>It is a graduation requirement of the Heavy Equipment Operations (HEO) one-year certificate for students to earn a grade of “C” or better in all “Heavy Equipment Operations (HEO)” courses; due to state licensing requirements, students must earn a grade of “B” or better in the CDL class.</p>			
		<b>PROGRAM TOTAL</b>	<b>45</b>

**HEO 100 First Aid and Safety.** This course is designed to introduce students to the possible safety hazards associated with working around heavy equipment. Students will become familiar with procedures sanctioned by the American Red Cross and receive training in the identification of emergency situations and safe performance of common construction applications. 1 credit hour.

**HEO 102 Basics of Heavy Equipment Operation.** This course is designed to give the student a basic understanding of basic tools and blueprints used in the construction trade. 1 credit hour.

**HEO 105 Orientation to the Trade.** This course introduces the Heavy Equipment Operations student to the different aspects and requirements for the heavy equipment operations trade as well as educating the student in the proper care and preventive maintenance of construction equipment. 1 credit hour.

**HEO 106 Introduction to Heavy Equipment Operations.** This course introduces the Heavy Equipment Operations student to the identification, use and description of basic operation of different types of heavy equipment including bulldozers, scrapers, excavators, and loaders. Students are provided a broad introduction to the processes of planning and executing earth moving activities on various types of construction projects. 1 credit hour.

**HEO 108 Introduction to OSHA Regulations.** This course provides the required industry training that meets the Occupational Safety & Health Administration (OSHA) 10 hour safety training regulation. The areas of required studies are Introduction to OSHA, General Safety and Health, Personal Protective Equipment, Electrical Safety, Fall Protection, Cranes, Confined Space Entry, Excavations, Stairways and Ladders, Hand and Power Tools, and Motor Vehicles. To complete this course and receive the OSHA 10 hour certification card, the student must pass the OSHA written exam. 1 credit hour.

**HEO 112 Applied Measurement in Construction.** Practical mathematics taught with applications that apply to the horizontal construction industry. Reading engineers scale, conversions of decimals, fractions and percents, and basic calculations for earth work quantities. 2 credit hours.

**HEO 115 Welding.** Includes basic principles and fundamentals of arc welding and acetylene cutting as applied to heavy equipment repairs. Also covers basic welding and acetylene safety. 1 credit hour.

**HEO 121 Environmental Compliance.** This course provides an introduction to the various federal and state laws which govern the construction industry, followed by more in-depth learning about the specific issues students are likely to encounter as heavy equipment operators. Students will gain an awareness of topics ranging from solid and hazardous waste management, to water and air quality, to cultural resources, endangered species, and specifics of regulations related to demolition and earthmoving that are common to the industry. 1 credit hour.



**HEO 131 Heavy Equipment Operations Internship.** The Heavy Equipment Operations Internship is comprised of on-the-job training provided by employers on actual construction sites. A training agreement specifies the tasks the student will be expected to perform. The instructor will determine the number of hours a student will participate in the internship. Prerequisites: Earn a grade of “C” or better in all HEO courses, a grade of “D” or better in all General Education Requirement courses, pass the exit exam, and obtain the approval of their advisor. 3 credit hours.

**HEO 134 Safety and Loss Control.** This course provides classroom instruction on the responsibilities of the finish operator and how these responsibilities affect financial losses due to safety and operation decisions. The student is introduced to basic skills for the finish operator covering basic project planning and scheduling techniques as well as coordination and communication of work assignments to heavy equipment operators and other trades and crafts. This course also describes project setup, materials purchasing, effects of soil testing, and primary safety programs. Prerequisites: HEO 100, HEO 102, HEO 105, and HEO 106 with a grade of “C” or better. 3 credit hours.

**HEO 138 Advanced Operating Techniques.** This course teaches advanced topics for equipment operators including safety, controlling and working around water, calculating costs, and the effects of different soil types. Prerequisite: HEO 134 with a grade of “C” or better. 1 credit hour.

**HEO 139 Grade Operations.** This course provides the student with details about the staking and grading operations of a construction projects. It addresses staking requirements for roads, commercial buildings, and trenches. Students are trained to read and interpret various plan sheets that contain grading information. 2 credit hours.

**HEO 146 Backhoe and Excavator.** This course introduces basic identification of components, backhoe and excavator safety, use of operators manual, daily servicing and operation of the machine teaching students to start the machine, move it, and shut it down. Included are basic backhoe and excavator operation and maintenance so that students will operate a backhoe and excavator to perform specific tasks. 4 credit hours.

**HEO 147 Dozer and Scraper.** This course introduces basic dozer and scraper operation and maintenance, identification of components, dozer and scraper safety, use of operators manual, daily servicing and operation of the machine to the point where the student can safely start the machine, move it, and shut it down. The student will operate both dozer and scraper to perform specific tasks. 4 credit hours.

**HEO 148 Loader.** The student will be introduced to the practical operation of a front end loader to perform specific tasks, basic loader operation and maintenance. Students will also be introduced to basic identification of components, front-end loader safety, use of operators manual, daily servicing and operation of the machine to the point where the students can start the machine, move it, and shut it down. Operation of a front end loader to perform specific tasks will be taught. 4 credit hours.

**HEO 149 Motor Grader and Skid Steer.** This course will introduce basic machine operation and maintenance including identification of components, safety, use of operators manuals, daily servicing and operation of the machine to the point where the student can start the machine, move it, and shut it down. The student will also operate a motor grader and skid steer loader to perform specific tasks. 4 credit hours.

**HEO 150 Commercial Driver License.** The Commercial Driver’s License (CDL) course is a professional course focused on the fundamentals of safe driving practices and identifying the hazards of a Class “A” Commercial Motor Vehicle (CMV). The student will be able to inspect a commercial motor vehicle, perform basic maneuver skills, and display safe on-road skills on public streets and highways. Prerequisite: Eligibility for Class A Commercial Driver’s License (CDL) and successful drug screen. 4 credit hours.



**HEO 151 Basic Commercial Driver License.** This lecture course is a professional course that teaches the fundamentals of safe driving practices and identifying the hazards of a Class “A” Commercial Motor Vehicle. Students are prepared to take the written and pre-trip inspection portions of the Missouri Department Motor Vehicle Commercial Driver License (CDL) exam. This course is intended for non-HEO majors. Prerequisite: Instructor’s permission based on verification of: 1) driving record that is eligible for a Missouri Class A CDL, 2) complete, current, and valid Medical Examination Report and Certificate for Commercial Driver Fitness Determination, and 3) successful drug screen(s). 1 credit hour.

**HEO 152 Basic Commercial Driver License Lab.** The Commercial Driver License (CDL) lab teaches Commercial Motor Vehicle (CMV) pre-trip inspection requirements, basic maneuver skills, safe on-road skills that are performed on public streets and highways. This course is intended for non-HEO majors. Corequisite: HEO 151. Note: Each student will be required to have a Class A CDL permit for the driving portion of this class and maintain eligibility to take the Missouri Class A CDL examination. 1 credit hour.

**HEO 299 Special Topics in Heavy Equipment Operations.** Special Topics in Heavy Equipment Operations (HEO) may include instruction on topics not covered in other HEO courses. Topics covered in other HEO courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



*The AED Foundation*  
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## **HEAVY EQUIPMENT TECHNOLOGY**

### **GENERAL OPTION**

**47.0302**

*(Associate of Applied Science Degree)*

The Heavy Equipment Technology program prepares individuals to perform maintenance, troubleshooting and overhaul of the major components of earth moving equipment. Instruction is provided in the classroom on theory, inspection, maintenance, troubleshooting and repair of tracks, wheels, brakes, operating controls, hydraulic systems, electrical circuitry, electronic and mechanical engines, manual and power shift transmissions. Some equipment operation is included to familiarize students with the equipment they are learning to repair.

The Heavy Equipment Technology program contributes to the green economy by updating the curriculum each year to include the latest technology used to meet Environmental Protection Agency (EPA) regulations regarding emission and control systems. The newest tier of engine training, tier four, includes alternative fuels. Additional technology being developed includes hybrid powertrain systems, multi-fueled engines, and the “green” diesel engine that produces post-combustion air that is cleaner than the intake air, which positively affects the carbon footprint.

Graduates of the two-year Associate of Applied Science degree program will have the technical competencies required to be productive in an entry-level heavy equipment technician position. They can expect to find employment with construction companies, heavy equipment sales and service organizations, dealers, state highway maintenance departments and mining companies. The Heavy Equipment Technology program is accredited by the Associated Equipment Distributors (AED) Foundation. The program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

It is a graduation requirement of the Heavy Equipment Technology (HET) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

#### **Program Mission**

The mission of the Heavy Equipment Technology program is to provide students with the opportunity to develop the technical and interpersonal skills necessary to succeed in today’s Heavy Equipment Technology field.

#### **Program Goals**

The goals of the program are to:

- Provide the opportunity for students to develop electrical knowledge and skills needed to repair and maintain heavy equipment.
- Provide the opportunity for students to develop the knowledge and skills necessary to repair, maintain and troubleshoot diesel engines.
- Provide the opportunity for students to develop knowledge and skills necessary to repair, maintain and troubleshoot of hydraulic and drive train systems as they relate to heavy equipment.



- Provide an opportunity for students to develop and demonstrate critical thinking skills used in troubleshooting.
- Assure that students have the opportunity to develop oral and written communication skills needed in the diesel mechanic's field.

**CORE CURRICULUM**

			<b>Credit Hours</b>
HET	140	Introduction to Equipment, Tracks, Tires and U/C	2
HET	141	Fluids and Filtration	3
HET	145	Engines I	3
HET	191	Internship I	8
HET	242	Electrical Systems I	3
HET	243	Electrical Systems II	3
HET	244	Hydraulics I	3
HET	245	Hydraulics II	3
HET	246	Power Train I	3
HET	247	Power Train II	3
HET	251	Job Estimating, Diagnosis and Field Repair	4
HET	255	Engines II	3
		<b>SUB-TOTAL</b>	<b>41</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
May Not Include: MAT 116 College Algebra Using Mathematical Modeling			3
		<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

MHT	280	Heating and Air Conditioning	3
MHT	180	Truck Welding	2
OR			
HET	250	Failure Analysis	3
OR			
MPT	165	Basic Welding	3
COM	211	Technical Writing	3
<b>Optional:</b>			
HEO	151	Basic Commercial Driver License (Optional)	(1)
HEO	152	Basic Commercial Driver License Lab (Optional)	(1)
MTT	196	Machining Essentials (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>8-14</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Heavy Equipment Technology (HET) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses.

**PROGRAM TOTAL 69-75**

**HET 140** Introduction to Equipment Tracks, Tires and U/C. This course discusses various types of machinery. Introduction of preventive maintenance, proper starting procedure and operation. Also describes proper maintenance, adjustments and installation of undercarriage. 2 credit hours.



**HET 141 Fluids and Filtration.** This course discusses the purpose and characteristics of the different types of fuel, oil and lubricants. Also, the coolant system and filterization are discussed and applied. 3 credit hours.

**HET 145 Engines I.** Basic engine systems are the core components taught in this course. Participants will learn and discuss related component operations and their specific functions pertaining to engine performance. Activities will include engine overhaul, inspection, repair and maintenance. 3 credit hours.

**HET 191 Internship I.** The Heavy Equipment Technology Internship I is comprised of 640 hours of paid work experience in a heavy equipment dealership requiring the student to perform a variety of tasks. The student will be required to work eight hours per day for sixteen weeks. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of activities (tasks performed). 8 credit hours.

**HET 242 Electrical Systems I.** This course discusses the theory of electrical components and symbols, batteries, wiring and connector maintenance, schematic readings, starting systems, charging systems, and lighting systems. Diagnostic tooling is discussed and applied in detail. 3 credit hours.

**HET 243 Electrical Systems II.** This course teaches the fundamentals of electronics and computers, diagnosis and repair of electronic circuits, multiplexing, and the diagnosis and repair of electronically-controlled power train systems. Prerequisite: HET 242. 3 credit hours.

**HET 244 Hydraulics I.** This course discusses the theory of fluid power and hydraulics. Basic pump, motors and systems are explained. 3 credit hours.

**HET 245 Hydraulics II.** This course describes different types of hydraulics systems, schematic reading ISO symbols, diagnostic tooling, hoses and couplings. Prerequisite: HET 244. 3 credit hours.

**HET 246 Power Train I.** This course describes various transmission, torque converters, differentials, final drives and proper use of tooling. 3 credit hours.

**HET 247 Power Train II.** This course teaches assembly, disassembly rebuilding and troubleshooting of various makes and models. Prerequisite: HET 246. 3 credit hours.

**HET 250 Failure Analysis.** This course describes in detail how to analyze parts and system failures. 3 credit hours.

**HET 251 Job Estimating, Diagnosis and Field Repair.** This course will enable you to estimate jobs, diagnose equipment and perform field repairs. 4 credit hours.

**HET 255 Engines II.** This course will concentrate on advanced engine systems including ignition starting, charging, and fuel with emphasis on multi-fuel components and electronic engine control. Instruction includes the use of the latest computerized test equipment utilized in engine diagnostics. The course also includes instruction on mechanical and electronic governor control systems. Prerequisite: HET 145. Corequisite: AMT 145. 3 credit hours.

**HET 299 Special Topics in Heavy Equipment Technology.** Special Topics in Heavy Equipment Technology (HET) may include instruction on topics not covered in other HET courses. Topics covered in other HET courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



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**CAT DEALER SERVICE TECHNICIAN OPTION**  
**47.0302**

*(Associate of Applied Science Degree)*

This Associate of Applied Science Degree program is a college-level program that gives the student the education and skills needed to work on over 300 Caterpillar (CAT) machines and engines - including the biggest, hardest-working, most high tech equipment in the world. Paid internships at a local CAT Dealer give the student the money needed to complete the program - and the experience needed to land a great paying, challenging career. The CAT Dealer Service Technician Option is accredited by the Associated Equipment Distributors (AED) Foundation. The program is also accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

Enrollment in the CAT Dealer Service Technician Option is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline. In order to participate in the CAT Dealer Service Technician Option, each student must be sponsored by a CAT Dealer who provides four required internship experiences.

It is a requirement of the CAT Dealer Service Technician Option for students to maintain a cumulative grade point average of 3.000 on a 4.000 point grading scale to remain sponsored in the option.

**Program Mission**

The mission of the CAT Dealer Service Technician Option is to provide students with the opportunity to develop the technical skills necessary to succeed as a service technician on Caterpillar equipment and components.

**Program Goals**

The goals of the program are to provide the opportunity for students to develop:

- Knowledge and skills needed to repair, maintain, troubleshoot and diagnose Caterpillar equipment systems.
- Critical thinking skills used in troubleshooting and diagnostics and to demonstrate these skills.
- Oral and written communication skills needed to succeed in the Caterpillar Dealer network.

**CORE CURRICULUM**

			<b>Credit Hours</b>
CAT	110	CAT Engine Fundamentals	4
CAT	111	Introduction to CAT Service Industry	2
CAT	150	Internship I	4
CAT	112	Fundamentals of Hydraulics	3
CAT	113	CAT Engine Fuel Systems	3
CAT	114	Fundamentals of Electrical Systems	3
CAT	151	Internship II	4
CAT	115	Air Conditioning	2
CAT	116	Fundamental Transmissions/Torque Converters	3
CAT	117	Machine Hydraulic Systems	3
CAT	250	Internship III	4
CAT	200	U/C and Final Drive	3
CAT	201	Machine Electronic Systems	3



CAT	251	Internship IV	4
CAT	202	CAT Engine Performance	2
CAT	203	Diagnostic Testing	2
CAT	204	Machine Specific Systems	4
		<b>SUB-TOTAL</b>	<b>53</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>			
		General Education Requirements (see page 44)	19
		May Not Include: MAT 116 College Algebra Using Mathematical Modeling	3
		OR	
		MAT 118 Survey of College Mathematics	3
		<b>SUB-TOTAL</b>	<b>19</b>
<b>PROGRAM REQUIREMENT</b>			
WLD	120	CAT Welding	2
<b>Optional:</b>			
HEO	151	Basic Commercial Driver License (Optional)	(1)
HEO	152	Basic Commercial Driver License Lab (Optional)	(1)
MTT	196	Machining Essentials (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>2-7</b>
<b>GRADUATION REQUIREMENT</b>			
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		<b>PROGRAM TOTAL</b>	<b>75-80</b>

**CAT 110** CAT Engine Fundamentals. The principles of compression ignited internal combustion engines are taught and variations in design are discussed. Caterpillar engines are used for laboratory disassembly and assembly. 4 credit hours.

**CAT 111** Introduction to CAT Service Industry. This course provides instruction and laboratory experience in shop safety, shop operation and how to obtain Caterpillar service information. 2 credit hours.

**CAT 112** Fundamentals of Hydraulics. This course is a practical study of the basic principles and components of hydraulic circuits and the application of these principles to Caterpillar competencies in the areas of servicing and maintaining hydraulic equipment. Laboratory practices include disassembly and reassembly of components and tracing circuits. 3 credit hours.

**CAT 113** CAT Engine Fuel Systems. This course is a study of combustion chamber design, Caterpillar fuel injection systems and diagnosing faults in fuel injection and combustion systems. 3 credit hours.

**CAT 114** Fundamentals of Electrical Systems. This course is designed to include electrical concepts as they apply to electrical systems. It will include the use of electrical test equipment to diagnose electrical problems found on Caterpillar equipment and engines. 3 credit hours.

**CAT 115** Air Conditioning. This course provides an introduction into the basic theory and principles of air conditioning as they relate to Caterpillar equipment. Use of equipment to diagnose and repair malfunctions, including repair of component parts and the charging and recharging of systems will be stressed in the laboratory. 2 credit hours.

**CAT 116** Fundamentals of Transmissions & Torque Converters. A study is made of the various sliding gear, hydrostatic synchromesh and power shift transmissions involving planetaries. 3 credit hours.



**CAT 117 Machine Hydraulic Systems**. This course is designed for inspecting, testing, servicing and diagnosing Caterpillar basic hydraulic systems. 3 credit hours.

**CAT 150 Internship I**. This supervised experience is required of students enrolled in the CAT Dealer Service Technician curriculum. Placement is obtained through the cooperation of a CAT dealer. Student's needs and objectives determine major emphasis. Prerequisite: Department Chair approval. 4 credit hours.

**CAT 151 Internship II**. This supervised experience is required of students enrolled in the CAT Dealer Service Technician curriculum. Placement is obtained through the cooperation of a CAT dealer. Student's needs and objectives determine major emphasis. Prerequisite: Department Chair approval. 4 credit hours.

**CAT 200 Undercarriage and Final Drive**. This course is a continuation of power train systems with emphasis on final drives and track systems. 3 credit hours.

**CAT 201 Machine Electronic Systems**. This course provides the background needed to diagnose and repair the sophisticated electronics and computerized circuits found on Caterpillar equipment and engines. Basic electronic concepts, component function and identify malfunctions and to test the systems properly. 3 credit hours.

**CAT 202 CAT Engine Performance**. A course to provide a thorough understanding of the necessary diagnostic skills required for troubleshooting Caterpillar engines and fuel systems. Emphasis will be placed upon knowledge and skills necessary to assure product reliability and performance. 2 credit hours.

**CAT 203 Diagnostic Testing**. This is a course that studies the practical use of diagnostic equipment for analyzing and repairing Caterpillar machine and engine systems. 2 credit hours.

**CAT 204 Machine Specific Systems**. This course is designed to develop knowledge and skills used to test and adjust specific Caterpillar machine systems. 4 credit hours.

**CAT 250 Internship III**. This supervised experience is required of students enrolled in the CAT Dealer Service Technician curriculum. Placement is obtained through the cooperation of a CAT dealer. Student's needs and objectives determine major emphasis. Prerequisite: Department Chair approval. 4 credit hours.

**CAT 251 Internship IV**. This supervised experience is required of students enrolled in the CAT Dealer Service Technician curriculum. Placement is obtained through the cooperation of a CAT dealer. Student's needs and objectives determine major emphasis. Prerequisite: Department Chair approval. 4 credit hours.



The Association of Technology,  
Management, and Applied Engineering

**INDUSTRIAL ELECTRICITY**  
**46.0302**  
*(Associate of Applied Science Degree)*

The Industrial Electricity program prepares individuals to install, operate, maintain, and repair electrically-energized systems such as electric power wiring and industrial process control systems. The electrical field is one of the fastest growing craft occupations and offers relatively high earnings. Students who graduate from the program at Linn State Technical College can expect to have the knowledge necessary to pass various maintenance and journeyman electrical licensing examinations, which are required for employment in many localities.

The Industrial Electricity Associate of Applied Science degree includes three emphasis areas in Construction, Electronic Controls, and Programmable Logic Controllers. An Electromechanical One-Year Certificate is also offered. These three program emphasis areas and the certificate allow students the flexibility to choose the electrical field that best suits their individual career goals.

The program provides extensive hands-on practical training in small classes taught by instructors who have worked in the electrical field. Courses in electricity, electronics, blueprint reading, science, and general studies develop the competencies of both construction and maintenance electricians. Students receive introductory training in programmable logic controllers (PLCs), which is the field's fastest growing and most in-demand skill. Students who select the PLC emphasis area will receive extensive PLC training and are among the industry's most sought-after graduates. Solar and wind technology are introduced as emerging sources of available power to students in the Construction and PLC emphasis areas. All students receive CPR training. Safety and electrical code requirements are stressed in all classes. The department elicits input from industrial advisors and adapts the program continually to meet hiring requirements in the ever-changing electrical field.

The curriculum provides the hands-on skills and knowledge required for entry-level employment. Employment opportunities may be found in schools; hospitals; manufacturing; federal and state government; military-support; building complexes; and residential, commercial, and industrial construction.

The Industrial Electricity program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

**Program Mission**

The mission of the Industrial Electricity program is to enhance technical and economic development in the state by providing to Missouri's growing industries; quality technicians, technical training, consultation, and research in the industrial electricity area and to provide advanced specialized technical education in both conventional and emerging technologies that maximizes the potential of each student for meaningful employment and progress in their chosen field.



**Program Goals**

The goals of the program are to:

- Assure that students develop the manual and critical thinking skills required to design, install, and repair electronic and electromechanical systems, in commercial and industrial settings.
- Teach and model attitudes, ethics, and communication skills, that enhance students' ability to secure and maintain increasingly meaningful employment in their chosen fields.
- Assure students' increasing awareness of potential hazards and of safety practices required to prevent injuries and material damage.

**CORE CURRICULUM**

			<b>Credit Hours</b>
IEL	115	Basic Motor Controls	3
IEL	211	Transformers	2
IEL	260	Motors	2
IEL	208	Integrated Mechanical Systems	3
IEL	217	Advanced Motor Controls	3
IEL	257	Power Distribution	2
IEL	221	Frequency Drives	3
<b>SUB-TOTAL</b>			<b>18</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
	Must Include:	PHY 101/102 College Physics	4
<b>SUB-TOTAL</b>			<b>19</b>

**PROGRAM REQUIREMENTS**

<b>Construction Emphasis</b>			
IEL	102	Safety and Accident Prevention	2
IEL	117	Circuitry Fundamentals w/Lab	4
IEL	201	Industrial Wiring I	4
IEL	128	National Electrical Code (NEC)	3
IEL	106	Electrical Blueprint Reading	2
IEL	122	Power Regulation	2
IEL	230	Industrial Electricity Internship I	4
OR			
IEL	251	Industrial Wiring II	
MPT	165	Basic Welding	3
EMS	120	Trigonometry for Industrial Electricity	3
OR			
MAT	121	Trigonometry	
COM	211	Technical Writing	3
OR			
COM	201	Occupational Communication	
<b>SUB-TOTAL</b>			<b>30</b>

**OR**

<b>Electronic Controls Emphasis</b>			
EET	125	Digital Electronics w/Lab	4
EET	126	DC/AC Circuit Analysis	6
EET	127	DC/AC Circuit Analysis Lab	2



EET	130	Semiconductor Devices and Analog Circuits	6
EET	131	Semiconductor Devices and Analog Circuits Lab	2
EET	140	Microcomputer Hardware, Operation and Repair	4
IEL	255	Basic Programmable Logic Controllers	4
IEL	275	Advanced Programmable Logic Controllers	4
COM	211	Technical Writing	3
OR			
COM	201	Occupational Communication	
		<b>SUB-TOTAL</b>	<b>35</b>

**OR**

		<b>Programmable Logic Controllers Emphasis</b>	
IEL	102	Safety and Accident Prevention	2
IEL	117	Circuitry Fundamentals w/Lab	4
IEL	201	Industrial Wiring I	4
IEL	128	National Electrical Code (NEC)	3
IEL	106	Electrical Blueprint Reading	2
IEL	122	Power Regulation	2
IEL	255	Basic Programmable Logic Controllers	4
IEL	275	Advanced Programmable Logic Controllers	4
EMS	120	Trigonometry for Industrial Electricity	3
OR			
MAT	121	Trigonometry	
COM	211	Technical Writing	3
OR			
COM	201	Occupational Communication	
		<b>SUB-TOTAL</b>	<b>31</b>

**GRADUATION REQUIREMENT**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

**PROGRAM TOTAL 68-73**

**INDUSTRIAL ELECTRICITY**

**Electromechanical**

**46.0302**

*(One-Year Certificate)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
IEL	102	Safety and Accident Prevention	2
IEL	106	Electrical Blueprint Reading	2
IEL	117	Circuitry Fundamentals w/Lab	4
IEL	115	Basic Motor Controls	3
IEL	217	Advanced Motor Controls	3
IEL	201	Industrial Wiring I	4
OR			
IEL	255	Basic Programmable Logic Controllers	
IEL	128	National Electrical Code (NEC)	3
IEL	208	Integrated Mechanical Systems	3
		<b>SUB-TOTAL</b>	<b>24</b>



		<b>GENERAL EDUCATION REQUIREMENTS</b>	
CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			
COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
		<b>SUB-TOTAL</b>	<b>6</b>
		<b>PROGRAM REQUIREMENT</b>	
MPT	165	Basic Welding	3
		<b>SUB-TOTAL</b>	<b>3</b>
		<b>GRADUATION REQUIREMENT</b>	
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		<b>PROGRAM TOTAL</b>	<b>34</b>

**IEL 102** Safety and Accident Prevention. This course teaches the hazards associated with industrial electricity, electric power generation, safety rules and safe work practices, OSHA rules and regulations associated with this industry, and the reporting procedures and the penalties that pertain to these regulations. 2 credit hours.

**IEL 106** Electrical Blueprint Reading. A course designed to develop the students' ability to understand all the major aspects of interpreting electrical blueprints. The fundamentals of electrical wiring schematics and diagrams are covered. 2 credit hours.

**IEL 115** Basic Motor Controls. This course introduces key concepts in electro-magnetic theory. These concepts are then developed and applied to the use of various devices commonly used in the electrical field such as coils, relays, solenoids, contactors, motor starters and their applications. Schematics are drawn and trainers are wired using the above components. Applications of AC/DC motors, switchgear control motors and switch-motors are discussed. Corequisite: IEL 117 or EET 126 and EET 127. 3 credit hours.

**IEL 117** Circuitry Fundamentals with Lab. This course introduces and develops the concepts necessary for understanding the use of electrical components and circuitry. The first half of the semester is devoted to DC, the second to AC. 4 credit hours.

**IEL 122** Power Regulation. This course explores power production and distribution from the supply side including the cause and effect of utility-supplied voltage variations and outages. Measures to increase power quality and reduce outage frequency are presented. Components of power factor are examined and analyzed mathematically. Component and systemic problems created by and measures to mitigate harmonic distortion are analyzed. Additional topics covered include AC circuit calculation, power rectification, and voltage regulators. All aspects of alternating current switchgear including single and poly-phase transformers, generators, paralleling assemblies, and instrumentation are covered. Renewable energy and alternative energy power producing products and switchgear such as wind turbines, cogeneration, and charge controllers are examined. Instruction will be provided for solar grid-tie, stand-alone solar, and DC to AC production and energy management. Additionally, electric utility peak shaving, energy use cycle, and demand/cost fundamentals are analyzed. 2 credit hours.



**IEL 128 National Electrical Code.** This course provides an overview of the National Electrical Code. It includes instruction in the use and application of the various tables and appendixes included in the code. 3 credit hours.

**IEL 201 Industrial Wiring I.** This course covers the knowledge and skills necessary in industrial wiring. Topics include load calculations, wire sizing, transformer connections and conduit sizing and bending of rigid conduit. Prerequisite: IEL 115. 4 credit hours.

**IEL 208 Integrated Mechanical Systems.** This course includes the calculation and design of mechanical, hydraulic, pneumatic systems and their interfaces. Students will also design a conveyor system that includes roller diameter, gear drive ratio and horsepower. 3 credit hours.

**IEL 211 Transformers.** This course develops the concepts introduced in IEL 115 and IEL 117 as related to the theory and operation of transformers. Prerequisite: IEL 115. 2 credit hours.

**IEL 217 Advanced Motor Controls.** This course builds on the schematic and ladder logic concepts previously learned using control relay and hard-wired devices and applies them to the manufacturing processes. Students are acquainted with programmable logic basics towards the end of the class and continue to build on them, which will better prepare them for additional PLC training. Prerequisite: IEL 115. 3 credit hours.

**IEL 221 Frequency Drives.** This course explains and applies frequency drive systems such as soft starts, DC and AC drives, braking and regeneration. Prerequisite: IEL 217. 3 credit hours.

**IEL 230 Industrial Electricity Internship I.** This internship is comprised of 320 hours of paid work experience as a construction or manufacturing electrician and must include a variety of tasks typical to that field. The student will be required to work eight hours per day for eight weeks or the equivalent. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of tasks performed. 4 credit hours.

**IEL 251 Industrial Wiring II.** This course is a continuation of course IEL 201 (Industrial Wiring I). Students perform jobs around the campus that will be seen in real life situations. Students will be required to fill out work orders to account for time and materials. Prerequisite: IEL 201. 4 credit hours.

**IEL 255 Basic Programmable Logic Controllers.** This course requires students to design and apply programmable controls systems to industrial processes. Allen Bradley-Rockwell 1000, 500, and 5000 software program systems are used. Prerequisite: IEL 217. 4 credit hours.

**IEL 257 Power Distribution.** This is a capstone course in electrical system design which includes sizing, ordering and the interface of industrial transformers, load centers, switch gear and other electrical equipment. 2 credit hours.

**IEL 260 Motors.** This course develops the concepts introduced in IEL 115 and IEL 117 as related to the theory and operation of motors. Prerequisite: IEL 115. 2 credit hours.

**IEL 272 Topics in Electrical System Design.** This course is an independent study course designed to develop and enhance the special interests of advanced students. Projects and topics will be individualized and will include research, application of theory and design of electrical and electro-mechanical systems. Subject matter and credit granted for this course must be prearranged with the instructor and approved by the Department Chairperson. Credit granted for this course ranges between 3 and 6 credit hours. Prerequisite: Permission of instructor. 3-6 credit hours.



**IEL 275 Advanced Programmable Controllers.** This advanced course requires students to design and apply programmable control systems of increased complexity. Process and motion control applications are included. Allen Bradley, Gould/Modicon and other systems are used and programmed. Prerequisite: IEL 255. 4 credit hours.

**IEL 299 Special Topics in Industrial Electricity.** Special Topics in Industrial Electricity (IEL) may include instruction on topics not covered in other IEL courses. Topics covered in other IEL courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## INDUSTRIAL MAINTENANCE TECHNOLOGY

47.0399

*(Associate of Applied Science Degree)*

The Industrial Maintenance Technology program is designed to develop the broad range of skills needed by industrial technicians who work on mechanical, electrical, hydraulic, piping, heating, ventilation, and air conditioning systems. These technicians also install, maintain, and repair specialized equipment and machinery found in various businesses and industry operations.

Industrial Maintenance Technology prepares students to continue growing in their profession as technology changes.

In the Industrial Maintenance Technology program at Linn State Technical College, students take courses in four different majors including Industrial Electricity (IEL); Heating, Ventilation, & Air Conditioning Technology (HVT); Heavy Equipment Technology (HET); and Machine Tool Technology (MTT). Students also get a solid foundation in math, communications, and welding. Each student has the option to participate in an internship to learn and practice skills on the job.

Employment opportunities exist for graduates in health care facilities, hotels and resorts, manufacturing operations, public utilities, power plants, government agencies, educational institutions, retail and other operations.

### Program Mission

The mission of the Industrial Maintenance Technology program is to prepare students to install, maintain, and repair industrial systems and equipment.

### Program Goals

The goals of the program are to provide students with the opportunity to develop:

- Technical knowledge and skills required to install, maintain, and repair industrial systems and equipment.
- Working knowledge of the safety standards applicable to industrial technology to prevent injuries and material damage.
- Analytical and problem solving skills needed to succeed as an industrial technician.
- Effective communication and interpersonal skills needed to succeed as an industrial technician.
- Work ethic and attitudes that enhance the ability to secure and maintain increasingly meaningful employment.

### CORE CURRICULUM

			<b>Credit Hours</b>
HET	145	Engines I	3
HET	244	Hydraulics I	3
HVT	151	Fundamentals of Refrigeration, Air Conditioning and Introduction to Domestic Refrigeration	6
HVT	152	Domestic and Commercial Refrigeration w/Lab	6
IEL	106	Electrical Blueprint Reading	2
IEL	117	Circuitry Fundamentals w/Lab	4
IEL	208	Integrated Mechanical Systems	3
MPT	165	Basic Welding	3
MTT	100	Precision Machining Practices I	6
COM	211	Technical Writing	3
<b>Optional:</b>			
IMT	190	Internship I (Optional)	(4)
		<b>SUB-TOTAL</b>	<b>39-43</b>



<b>GENERAL EDUCATION REQUIREMENTS</b>		
General Education Requirements (see page 44)		19
<b>SUB-TOTAL</b>		<b>19</b>
<b>PROGRAM REQUIREMENTS</b>		
IEL 115	Basic Motor Controls	3
IEL 217	Advanced Motor Controls	3
IEL 255	Basic Programmable Logic Controllers	4
IEL 257	Power Distribution	2
<b>SUB-TOTAL</b>		<b>12</b>
<b>GRADUATION REQUIREMENT</b>		
BUS 125	Job Search Strategies	1
<b>SUB-TOTAL</b>		<b>1</b>
<b>PROGRAM TOTAL</b>		<b>71-75</b>

**IMT 190 Internship I.** Students are required to work a minimum of four weeks and perform a variety of tasks. Program objectives, students' educational objectives, and the employer's on-the-job training capabilities determine internship content and objectives. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of activities (tasks performed). Prerequisite: Department Chair approval. 4 credit hours.

**IMT 299 Special Topics in Industrial Maintenance Technology.** Special Topics in Industrial Maintenance Technology (IMT) may include instruction on topics not covered in other IMT courses. Topics covered in other IMT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**National Institute for Metalworking Skills®**



The Association of Technology,  
Management, and Applied Engineering

## **MACHINE TOOL TECHNOLOGY**

**48.0501**

*(Associate of Applied Science Degree)*

Precision. Quality. High-speed machining. That’s what it takes to create many of the items in your home and office. And if the items weren’t created by precision machining technology, then the machinery and equipment needed to produce these products were developed using it.

In our program, students are taught how to select the right machining process, plan that process and operate computer numerical control (CNC) and manual precision machine tools to create parts or products. Our state-of-the-art lab includes 4- and 5-Axis machining centers, CNC milling machines and lathes, a three-dimensional printer, electrical discharge machining (EDM) equipment and other industry standard equipment for students to use in hands-on labs. All labs are supervised by instructors with industry experience. The precision machining capstone projects help to prepare students for a challenging career in this high demand field. With your degree, you can choose careers including machining, CNC programming, mold/die making, quality control, or machine tool manufacturing.

The Machine Tool Technology program contributes to the green economy by recycling steel, aluminum, carbide inserts, brass and copper wire. Biodegradable metal cutting fluids and solutions are used to help reduce water, air, and soil contamination.

The Machine Tool Technology program is certified with the National Institute for Metalworking Skills (NIMS) and accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

It is a graduation requirement of the Machine Tool Technology (MTT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

### **Program Mission**

The mission of the Machine Tool Technology program is to prepare students with the skills, knowledge, and attributes required for the completion of an Associate of Applied Science degree in the Machine Tool Technology field.

### **Program Goals**

The goals of the program are to provide:

- Students with instruction in the technical skills and knowledge needed to transform ideas and drawings into precision machined parts.
- Instruction in machining skills by manual and computer operated machine tools.
- Instruction in math to compute the needed formulas required for accurate set up, location, feeds, speeds, and coordinates to produce required parts.
- Students with the opportunity to develop effective communications and interpersonal skills.

### **CORE CURRICULUM**

			<b>Credit Hours</b>
MTT	100	Precision Machining Practices I	6



MTT	110	Precision Machining Practices II	3
MTT	113	Industrial Science	3
MTT	120	CNC Programming – Milling	3
MTT	200	Grinding Technology	3
MTT	210	Fundamentals of CAD/CAM	3
MTT	220	CNC Programming – Turning and Wire EDM	3
MTT	230	Advanced CAD/CAM	3
MTT	231	Advanced CNC Machining Applications Lab	3
MTT	290	Precision Machining Capstone Course	3
<b>Optional:</b>			
MTT	190	Machine Tool Technology Internship (Optional)	(4)
MTT	240	Solid Modeling Essentials (Optional)	(3)
<b>SUB-TOTAL</b>			<b>33-40</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
Must Include:	PHY 101/102 College Physics		4
	MAT 118 Survey of College Mathematics		3
<b>SUB-TOTAL</b>			<b>19</b>

**PROGRAM REQUIREMENTS**

DDT	135	Introductory Drafting Fundamentals	3
EMS	101	Statistical Process Control	1
MPT	165	Basic Welding	3
<b>SUB-TOTAL</b>			<b>7</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Machine Tool Technology (MTT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**PROGRAM TOTAL 60-67**

**MTT 100 Precision Machining Practices I.** This course provides the foundation for the use of precision machine technology, hand tools, machining processes, Machinery’s Handbook, measuring instruments, and manual machines for the precision machining trade. Emphasis is placed on skill development through projects in the lab. 6 credit hours.

**MTT 110 Precision Machining Practices II.** This course will continue the use of the knowledge and skills developed in Precision Machining Practices I. Emphasis is placed on completion of the National Institute of Manufacturing Skills (NIMS) projects and other lab projects. Prerequisite: MTT 100 with a grade of “C” or better. 3 credit hours.

**MTT 113 Industrial Science.** Introduction to Machinery’s Handbook and related formulas. Heat treating, metallurgy, material and machining applications, strengths of materials, and geometric dimensioning and tolerancing are discussed with an emphasis on practical application. 3 credit hours.



**MTT 120 CNC Programming - Milling.** This course is an introduction to the fundamentals of computer numerical control (CNC) as applied to milling machines. Instruction includes part planning, tooling usage, writing programs, and machine set-up and operation. Through laboratory assignments, students apply programming techniques and operate CNC equipment to produce machined projects. Prerequisite: MTT 100 with a grade of “C” or better. 3 credit hours.

**MTT 190 Machine Tool Technology Internship.** The Machine Tool Technology Internship is a planned work experience comprised of 320 hours of paid on-the-job training in a machining related field requiring the student to perform a variety of tasks. The student will be required to work eight hours per day for eight weeks. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of activities (tasks performed). Note: Elective courses may be substituted for internship courses at the discretion or approval of the department. Prerequisites: MTT 110 and MTT 120 with a grade of “C” or better and as stated in the Internship Handbook. 4 credit hours.

**MTT 196 Machining Essentials.** This course teaches how to safely perform fundamental machining operations using mills, lathes, and other machine shop equipment. Precision measurement skills are also included. 3 credit hours.

**MTT 200 Grinding Technology.** This course builds upon previous coursework. It includes grinding wheel construction, abrasives, set-up and procedures required to produce the surface finishes and close tolerances needed in industry. Skills and knowledge are developed through lecture and laboratory assignments. Prerequisite: MTT 110 with a grade of “C” or better. 3 credit hours.

**MTT 210 Fundamentals of CAD/CAM.** This course introduces the concepts and practices associated with using computer aided design/computer aided manufacturing (CAD/CAM) software to create programs for computer numerical control (CNC) milling machines. Instruction includes geometry creation and modification; process and toolpath planning; and toolpath generation. Through laboratory assignments, students apply programming techniques and operate CNC equipment to produce machined projects. Prerequisite: MTT 120 with a grade of “C” or better. 3 credit hours.

**MTT 220 CNC Programming - Turning and Wire EDM.** This is an advanced computer numerical control (CNC) G-code programming class for the CNC lathe and wire electrical discharge machine (EDM). Through laboratory assignments, students apply programming techniques and operate CNC equipment to produce machined projects. Prerequisite: MTT 120 with a grade of “C” or better. 3 credit hours.

**MTT 230 Advanced CAD/CAM.** This course provides instruction on how to use computer aided design/computer aided manufacturing (CAD/CAM) software to create advanced toolpath programs for three-dimensional, 4<sup>th</sup> and 5<sup>th</sup> axis milling machines, wire electrical discharge machines (EDM) and computer numerical control (CNC) lathes. Students build upon concepts learned in the Fundamentals of CAD/CAM class. Prerequisite: MTT 210 with a grade of “C” or better. Concurrent MTT 231. 3 credit hours.

**MTT 231 Advanced CNC Machining Applications Lab.** This course provides students with an advanced computer numerical control (CNC) machining lab to apply advanced computer aided design/computer aided manufacturing (CAD/CAM) concepts and implement CAD/CAM project designs by setting up and operating complex 4- and 5-axis machining and turning centers. Prerequisite: MTT 220 with a grade of “C” or better. Concurrent: MAT 230. 3 credit hours.

**MTT 240 Solid Modeling Essentials.** This course teaches the essential knowledge and skills to create parametric solid parts, assemblies and drawings. A conceptual foundation of solids is developed through case study based design projects. 3 credit hours.



**MTT 290 Precision Machining Capstone Course.** This is a project-oriented course that incorporates all machining operations into a real world scenario. The projects include necessary process documentation, computer numerical control (CNC), computer aided design/computer aided manufacturing (CAD/CAM), and manual machining operations. The student will design and make metal stamping or plastic injection tooling. Prerequisites: MTT 200, MTT 210 and MTT 220 with a grade of “C” or better. 3 credit hours.

**MTT 299 Special Topics in Machine Tool Technology.** Special Topics in Machine Tool Technology (MTT) may include instruction on topics not covered in other MTT courses. Topics covered in other MTT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



The Association of Technology,  
Management, and Applied Engineering

## **MEDIUM/HEAVY TRUCK TECHNOLOGY**

**47.0613**

*(Associate of Applied Science Degree)*

The Associate of Applied Science degree program in Medium/Heavy Truck Technology is designed to prepare skilled technicians to service medium and heavy duty trucks and similar diesel equipment. The Medium/Heavy Truck Technology program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE).

The Medium/Heavy Truck Technology program contributes to the green economy by updating the curriculum each year to include the latest technology used to meet Environmental Protection Agency (EPA) regulations regarding emission and control systems. The newest tier of engine training, tier four, includes alternative fuels. Additional technology being developed includes hybrid powertrain systems, multi-fueled engines, and the “green” diesel engine that produces post-combustion air that is cleaner than the intake air, which positively affects the carbon footprint.

Graduates of the program can expect to find employment in the service department of trucking companies, independent garages, automobile dealerships and construction companies. They can also expect to earn high wages after reaching the level of a skilled technician. Beginning apprentices usually earn from 50 to 70 percent of the rate of a skilled worker.

Due to industry employment requirements, students are required to earn a Class A Commercial Driver License (CDL) before graduation. The CDL training and licensing require students to: 1) maintain a driving record that is eligible for a Missouri Class A CDL, 2) obtain a complete, current, and valid Medical Examination Report and Certificate for Commercial Driver Fitness Determination, and 3) successfully pass drug screen(s).

It is a graduation requirement of the Medium/Heavy Truck Technology (MHT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses; due to state licensing requirements, students must earn a grade of “B” or better in the CDL classes.

### **Program Mission**

The mission of the Medium/Heavy Truck Technology program is to provide students with the opportunity to develop the technical and interpersonal skills necessary to succeed in today’s truck repair industry field.

### **Program Goals**

The goals of the program are to:

- Provide the opportunity for students to develop electrical knowledge and skills needed to repair and maintain heavy equipment.
- Provide the opportunity for students to develop the knowledge and skills necessary to repair, maintain and troubleshoot diesel engines.
- Provide the opportunity for students to develop knowledge and skills necessary to repair, maintain and troubleshoot of hydraulic and drive train systems as they relate to heavy equipment.
- Provide an opportunity for students to develop and demonstrate critical thinking skills used in troubleshooting.
- Assure that students have the opportunity to develop oral and written communication skills needed in the diesel mechanic’s field.



**CORE CURRICULUM**

			<b>Credit Hours</b>
MHT	102	Internship	8
MHT	130	Electrical and Electronic Systems	3
MHT	145	Engines I	3
MHT	160	Preventative Maintenance Inspection	3
MHT	170	Electrical and Electronic Systems II	3
MHT	180	Truck Welding	2
OR			
MPT	165	Basic Welding	3
MHT	200	Suspension and Steering	3
MHT	210	Brakes	3
MHT	220	Job Estimating, Diagnostics, Field Repair	5
MHT	240	Drive Train	3
MHT	255	Engines II	3
MHT	280	Heating and Air Conditioning	3
MHT	290	Basic Truck/Automotive Shop Management	3
<b>SUB-TOTAL</b>			<b>45-46</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
May Not Include: MAT 116 College Algebra Using Mathematical Modeling	3
<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

HEO	151	Basic Commercial Driver License	1
HEO	152	Basic Commercial Driver License Lab	1
HET	244	Hydraulics I	3
<b>Optional:</b>			
MTT	196	Machining Essentials (Optional)	(3)
<b>SUB-TOTAL</b>			<b>5-8</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Medium/Heavy Truck Technology (MHT) program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirements" courses; due to state licensing requirements, students must earn a grade of "B" or better in the CDL classes.

**PROGRAM TOTAL**

**70-74**

**MHT 102 Internship.** Training is provided by a skilled mentor or journeyman technician at a truck service center or repair shop under a training agreement with the Medium/Heavy Truck Technology program and training station. 8 credit hours.

**MHT 130 Electrical and Electronic Systems.** A study of the basic principles of magnetism and electricity, basic circuitry and the use of test equipment. Electrical accessories, electronic controls and computers are included. Included in this course is schematic and ISO symbol reading. 3 credit hours.



**MHT 145 Engines I.** Basic engine systems are the core components taught in this course. Participants will learn and discuss related component operations and their specific functions pertaining to engine performance. Activities will include engine overhaul, inspection, repair and maintenance. 3 credit hours.

**MHT 160 Preventative Maintenance Inspection.** A study of the procedures used to service all of the systems of trucks. This course provides extensive training in these systems: intake, exhaust, fuel and power train. 3 credit hours.

**MHT 170 Electrical and Electronic Systems II.** This course is a continuation of electrical and electronics found on today's medium and heavy duty trucks. Included will be discussions pertaining to diesel computer systems and multiplexing. Laboratory exercises will include the use of test equipment to identify malfunctions, determine causes and correct the malfunction of electronic circuits. Prerequisite: MHT 130. 3 credit hours.

**MHT 180 Truck Welding.** Basic principles and fundamental operations of arc welding, Mig, acetylene welding and cutting. 2 credit hours.

**MHT 200 Suspension and Steering.** A study of various types of steering systems and the advantages of each. Operating principles, testing and repair of power steering and wheel balancing and alignment are discussed and practiced. 3 credit hours.

**MHT 210 Brakes.** Covers braking systems used in tractors and trailers. Diagnosis and troubleshooting of the air and hydraulic systems. Adjustments to service and repair brakes will be performed. 3 credit hours.

**MHT 220 Job Estimating, Diagnostics, Field Repair.** This course will enable you to estimate jobs, diagnose equipment and perform field repairs. 5 credit hours.

**MHT 240 Drive Train.** Principles of operation and repairs of the truck transmission and differentials. Single and twin disc clutches are also discussed. 3 credit hours.

**MHT 255 Engines II.** This course will concentrate on advanced engine systems including ignition starting, charging, and fuel with emphasis on multi-fuel components and electronic engine control. Instruction includes the use of the latest computerized test equipment utilized in engine diagnostics. The course also includes instruction on mechanical and electronic governor control systems. Prerequisite: MHT 145 or Corequisite: AMT 145. 3 credit hours.

**MHT 280 Heating and Air Conditioning.** Heating and air conditioning systems used on medium and heavy duty trucks. Topics and practices will include environmental safety, refrigerant recycling, recharging systems and climate control. (Must pass the reclamation license test during the first week of class) 3 credit hours.

**MHT 290 Basic Truck/Automotive Shop Management.** This course provides an introduction to management principles and supervisory skills. Personnel policies and work procedures commonly found in truck service centers are reviewed. Topics discussed are: keeping accurate records, writing repair orders and handling customer relations. 3 credit hours.

**MHT 299 Special Topics in Medium/Heavy Truck Technology.** Special Topics in Medium/Heavy Truck Technology (MHT) may include instruction on topics not covered in other MHT courses. Topics covered in other MHT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



## **NETWORKING SYSTEMS TECHNOLOGY**

### **GENERAL OPTION**

### **TELECOMMUNICATIONS OPTION**

#### **11.0901**

*(Associate of Applied Science Degree)*

The Networking Systems Technology program is certified as a Cisco Certified Network Associate (CCNA) Local Academy, Cisco Certified Network Professional (CCNP) Local Academy, Fundamentals of Network Security (FNS) Local Academy and a CCNA Regional Academy. The Networking Systems Technology program is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). Both options include the Cisco certified course “Fundamentals of Voice and Data Cabling”. The Telecommunications Option also includes The Fiber Optic Association (FOA) certified course “Fiber Optic Technology.”

The degree program offers two tracks, which include the CCNA track or CCNP track. Entrance into a particular track is dependent upon previous training and certification. The CCNA track is for those students who have not taken or did not successfully complete Cisco semesters 1 through 4. Those students who have already achieved their CCNA or have successfully completed semesters 1 through 4 of the Cisco curriculum will be able to take the CCNP track. A student is required to take 4 semesters of Cisco courses at Linn State Technical College for graduation. This can be any combination of the CCNA & CCNP courses as long as prerequisites have been met.

The degree program also has two options both of which include Cisco instruction as described above. The first option is the General Option. The curriculum of the General Option focuses on networking from an industry perspective. The world continues to operate in the age of information technology. The demands on current network infrastructures require a network savvy workforce -- a workforce that can design or redesign networks and deploy new technologies while maintaining system up time with data and network security. A successful network technician must have a solid foundation of local area networking (LAN), wide area networking (WAN), computer hardware repair and installation, and computer software trouble shooting and installation skills in order to keep up with rapidly changing technologies.

The second option is the Telecommunications Option that prepares students for employment in the rapidly growing field of digital communications. The technician’s role is to provide customers with voice and data services through a variety of delivery systems. This includes network switching; Voice over Internet Protocol (VoIP); installation and repair of wireless and satellite equipment; T1 testing; fiber optics; digital home technology integration; and many other facets of this fast-paced industry.

A graduate of the Networking Systems Technology program will have the skills to work in areas such as LAN/WAN network, System Administration or Digital Communications.

It is a graduation requirement of the Networking Systems Technology (NST) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses. Students in both options are also required to pass one industry certification prior to graduation. Exam choices are specific to the curriculum and must be approved by the chair. The student is responsible for all certification exam fees.



**Program Mission**

The mission of the Networking Systems Technology program is to provide students with the technical and interpersonal skills needed to enter the field of computer networking or digital communications.

**Program Goals**

The goals of the program are to assure that the student:

- Has the opportunity to demonstrate oral and written communication skills.
- Has the opportunity to demonstrate analytical approaches to problem solving.
- Is provided an environment that allows the opportunity to demonstrate network administrator skills in business, government and/or in education.
- Is provided an environment that allows the opportunity to demonstrate project management skills.
- Is given the opportunity to demonstrate advanced network administrator skills or to plan, install and test the implementation and/or upgrade of digital communications systems.

**CORE CURRICULUM**

			<b>Credit Hours</b>
NST	103	Fundamentals of Voice and Data Cabling	3
NST	105	System Maintenance	3
NST	180	Internship I	4
NST	185	Internship II	4
OR			
NST	Elective	Networking Systems Technology Approved Elective	3
BUS	260	Project Management	3
<b>Optional:</b>			
NST	197	Internship III (Optional)	(4)
NST	207	Internship IV (Optional)	(4)
<b>SUB-TOTAL</b>			<b>16-25</b>

**AND**

			<b>Credit Hours</b>
<b>CCNA Track</b>			
NST	101	Network Fundamentals	3
NST	121	Routing Protocols and Concepts	3
NST	202	Local Area Network (LAN) Switching and Wireless	3
NST	219	Accessing the Wide Area Network (WAN)	3
<b>SUB-TOTAL</b>			<b>12</b>

**OR if CCNA Track is completed**

			<b>Credit Hours</b>
<b>CCNP Track</b>			
NST	225	Building Scalable Internetworks	3
NST	226	Building Multilayer Switched Networks	3
NST	227	Implementing Secure Converged Wide Area Networks (WAN)	3
NST	228	Optimizing Converged Networks	3
<b>SUB-TOTAL</b>			<b>12</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
	Must Include: PHY 101/102 College Physics		4
<b>SUB-TOTAL</b>			<b>19</b>



**PROGRAM REQUIREMENTS**

<b>General Option</b>			
NST	115	Operating Platforms	3
NST	205	Linux Administration and Installation	3
NST	210	Microsoft Network Administration	3
NST	292	Fundamentals of Network Security	6
NST/	Elective	Networking Systems Technology/Computer	3
CPP		Programming Approved Elective	
COM	211	Technical Writing	3
<b>Optional:</b>			
NST	275	Voice over IP (Optional)	(3)
<b>SUB-TOTAL</b>			<b>21-24</b>

**OR**

<b>Telecommunications Option</b>			
NST	123	Telecommunications Concepts	3
NST	139	Wireless Technology	3
NST	235	Fiber Optic Technology	3
NST	265	Digital Home Technology Integration	3
NST	271	Digital Switching I	3
NST	280	T1 Networking I	3
NST	275	Voice over IP	3
OR			
NST	285	T1 Networking II	
<b>SUB-TOTAL</b>			<b>21</b>

<b>GRADUATION REQUIREMENTS</b>			
BUS	125	Job Search Strategies	1
<b>SUB-TOTAL</b>			<b>1</b>

It is a graduation requirement of the Networking Systems Technology (NST) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirements” courses.

**PROGRAM TOTAL** **69-81**

**NETWORKING SYSTEMS TECHNOLOGY**

**11.0901**

*(One-Year Certificate)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
NST	101	Network Fundamentals	3
NST	103	Fundamentals of Voice and Data Cabling	3
NST	105	System Maintenance	3
NST	115	Operating Platforms	3
<b>SUB-TOTAL</b>			<b>12</b>





**NST 103 Fundamentals of Voice and Data Cabling.** This course, sponsored by Panduit, is designed for students interested in the physical aspects of voice and data network cabling and installation. The course focuses on cabling issues related to data and voice connections and provides an understanding of the industry and its worldwide standards, types of media and cabling, physical and logical networks, as well as signal transmission. Students will develop skills in reading network design documentation, part list set up and purchase, pulling and mounting cable, cable management, choosing wiring closets and patch panel installation and termination as well as installing jacks and cable testing. This hands-on, lab-oriented course stresses documentation, design, and installation issues, as well as laboratory safety, on-the-job safety, and working effectively in group environments. This course will help prepare students for the BICSI Registered Certified Installer, Level 1 exam. 3 credit hours.

**NST 105 System Maintenance.** This course covers the diagnosis, troubleshooting, and maintenance of computer components. Topics include hardware compatibility, system architecture, memory, input devices, video displays disk drives, modems and printers. 3 credit hours.

**NST 115 Operating Platforms.** Course covers popular Operating Systems. Use and installation is covered for each operating system. 3 credit hours.

**NST 121 Routing Protocols and Concepts.** This Cisco Certified Network Associate (CCNA) course describes the architecture, components, and operation of routers, and explains the principles of routing and routing protocols. Students analyze, configure, verify, and troubleshoot the primary routing protocols Routing Information Protocol (RIPv1), Routing Information Protocol (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), and Open Shortest Path First (OSPF). By the end of this course, students will be able to recognize and correct common routing issues and problems. Each chapter walks the student through a basic procedural lab, and then presents basic configuration, implementation, and troubleshooting labs. Packet Tracer (PT) activities reinforce new concepts, and allow students to model and analyze routing processes that may be difficult to visualize or understand. Prerequisite: NST 101 with a grade of “C” or better. 3 credit hours.

**NST 123 Telecommunications Concepts.** This course covers the history of telecommunications, regulatory events, principles of traffic engineering, services available, and factors to be considered in obtaining a new telephone system/new technology. 3 credit hours.

**NST 139 Wireless Technology.** This course defines the fundamentals of standards-based technology, giving the student an overview of the design, communication, hardware components, and maintenance associated with wireless Local Area Network (LAN) technology, commonly referred to as Wi-Fi. In addition, this course will prepare the student for the Certified Wireless Technology Specialist (CWTS) certification. Prerequisite: NST 103 with a grade of “C” or better. 3 credit hours.

**NST 180 Internship I.** A networking internship is comprised of work experience in a networking setting which requires the student to perform a variety of tasks. Internship sites must be approved by the department. Prerequisite: Chair approval. 4 credit hours.

**NST 185 Internship II.** A networking internship is comprised of work experience in a networking setting which requires the student to perform a variety of tasks. Internship sites must be approved by the department. Prerequisite: Chair approval. 4 credit hours.

**NST 197 Internship III (Optional).** A networking internship is comprised of work experience in a networking setting which requires the student to perform a variety of tasks. Internship sites must be approved by the department. Prerequisites: NST 180 and NST 185 or Chair approval. 4 credit hours.



**NST 202 Local Area Network (LAN) Switching and Wireless.** This Cisco Certified Network Associate (CCNA) course helps students develop an in-depth understanding of how switches operate and are implemented in the LAN environment for small and large networks. Beginning with a foundational overview of Ethernet, this course provides detailed explanations of LAN switch operation, Virtual Local Area Network (VLAN) implementation, Rapid Spanning Tree Protocol (RSTP), VLAN Trunking Protocol (VTP), Inter-VLAN routing, and wireless network operations. Students analyze, configure, verify, and troubleshoot VLANs, RSTP, VTP, and wireless networks. Campus network design and Layer 3 switching concepts are introduced. Prerequisite: NST 101 with a grade of “C” or better. 3 credit hours.

**NST 205 Linux Administration and Installation.** This course takes students through the process of learning Linux. Students will become familiar with the tools and processes relating to installing and administering a Linux system. 3 credit hours.

**NST 207 Internship IV (Optional).** A networking internship is comprised of work experience in a networking setting which requires the student to perform a variety of tasks. Internship sites must be approved by the department. Prerequisites: NST 180, NST 185, and NST 197 or Chair approval. 4 credit hours.

**NST 210 Microsoft Network Administration.** This course is an introduction to using Windows 2000 Server with Active Directory. Emphasis is placed on installation, configuration and implementation of a functional 2000 Server. 3 credit hours.

**NST 219 Accessing the Wide Area Network (WAN).** This Cisco Certified Network Associate (CCNA) course explains the principles of traffic control and access control lists (ACLs) and provides an overview of the services and protocols at the data link layer for wide-area access. Students learn about user access technologies and devices and discover how to implement and configure Point-to-Point Protocol (PPP), Point-to-Point Protocol over Ethernet (PPPoE), DSL, and Frame Relay. WAN security concepts, tunneling, and VPN basics are introduced. The course concludes with a discussion of the special network services required by converged applications and an Introduction to Quality of Service (QoS). Prerequisite: NST 101 with a grade of “C” or better. 3 credit hours.

**NST 225 Building Scalable Internetworks.** Building Scalable Internetworks is the first of four courses leading to the Cisco Certified Network Professional (CCNP) designation. Building Scalable Internetworks introduces Cisco Networking Academy Program students to scalable IP networks. Students will learn how to create an efficient and expandable enterprise network by installing, configuring, monitoring, and troubleshooting network infrastructure equipment (especially routers such as Cisco Integrated Service Routers (ISRs)). According to the Campus Infrastructure module in the Enterprise Composite Network model. Topics include how to configure Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF), Intermediary System to Intermediary System (IS-IS), and Border Gateway Protocol (BGP) routing protocols and how to manipulate and optimize routing updates between these routing protocols. Other topics include multicast routing, Internet Protocol version 6 (IPv6) and Dynamic Host Control Protocol (DHCP) configuration. Prerequisites: NST 101, NST 121, NST 202, and NST 219 with a grade of “C” or better. 3 credit hours.

**NST 226 Building Multilayer Switched Networks.** Building Multilayer Switched Networks is one of four courses leading to the Cisco Certified Network Professional (CCNP) designation. Multilayer Switching teaches students about the deployment of state-of-the-art campus LANs. The course focuses on the selection and implementation of the appropriate Cisco IOS services to build reliable, scalable multilayer-switched LANs. Students will develop skills in the following areas: Introduction to Campus Networks, Virtual Local Area Networks (VLANs), Spanning Tree Protocol, Inter-VLAN Routing, high availability in a campus environment, wireless client access, minimizing service loss and data theft in a campus network, configuring campus switches to support voice. Prerequisites: NST 101, NST 121, NST 202, and NST 219 with a grade of “C” or better. 3 credit hours.



**NST 227 Implementing Secure Converged Wide Area Networks (WAN).** Implementing Secure Converged Wide Area Networks is one of four courses leading to the Cisco Certified Network Professional (CCNP) designation. Implementing Secure Converged Wide Area Networks introduces Cisco Networking Academy Program students to providing secure enterprise-class network service for teleworkers and branch sites. Students will learn how to secure and expand the reach of an enterprise network with focus on Virtual Private Network (VPN) configuration and securing network access. Topics include teleworker configuration and access, frame-mode Multiprotocol Label Switching (MPLS), site-to-site Internet Protocol Security (IPSEC) VPN, Cisco Easy VPN (EZVPN), strategies used to mitigate network attacks, Cisco device hardening and IOS firewall features. Prerequisites: NST 101, NST 121, NST 202, and NST 219 with a grade of “C” or better. 3 credit hours.

**NST 228 Optimizing Converged Networks.** Optimizing Converged Networks is one of four courses leading to the Cisco Certified Network Professional (CCNP) designation. Optimizing Converged networks introduces Cisco Networking Academy Program students to optimizing and providing effective Quality of Service (QoS) techniques in converged networks operating voice, wireless and security applications. Topics include implementing a VOIP network, implementing QoS on converged networks, specific IP QoS mechanisms for implementing the DiffServ QoS model, AutoQoS wireless security and basic wireless management. Prerequisites: NST 101, NST 121, NST 202, and NST 219 with a grade of “C” or better. 3 credit hours.

**NST 235 Fiber Optic Technology.** This course will provide instruction in fiber optic technology including theory, safety, installation, splicing and testing techniques. Upon successful completion the student may receive Fiber Optic Technician Certification from The Fiber Optic Association. Prerequisite: NST 103. 3 credit hours.

**NST 252 CompTIA Network+.** This course serves as a general introduction for students to acquire a foundation in current network technologies for local area networks (LANs), wide area networks (WANs), and the Internet. It provides an introduction to the hardware, software, terminology, components, design, and connections of a network, as well as the topologies and protocols for LANs. It covers LAN-user concepts and basic functions of system administration and operation. The course uses a combination of lectures, demonstrations, discussions, and hands-on-labs. This course provides information necessary to pass the CompTIA Network+ exam. The course is also intended for those who will support or administer networks. Prerequisite: NST 105. 3 credit hours.

**NST 265 Digital Home Technology Integration.** Home Technology Integration (HTI) is the installation, integration, and troubleshooting of multiple interconnected digital electronic subsystems within the home and is considered one of the fastest growing technical career fields. This course teaches a broad range of basic HTI skills required to design, configure, integrate, maintain, and diagnose digital electronic home automation and control systems and prepares students for the CompTIA DHTI+ certification exam by using industry recognized curriculum, equipment, and labs. Prerequisites: NST 103 and NST 121 with a grade of “C” or better. 3 credit hours.

**NST 271 Digital Switching I.** The lecture portion of this course will cover the basic hardware components, the software system and the applications and capabilities of a digital switch. The hands-on portion will allow the students to log on, execute commands used to administer lines and trunks as well as perform maintenance on the machine. Prerequisite: NST 105. 3 credit hours.

**NST 275 Voice over IP.** The Internet Protocol (IP) is quickly changing all facets of communications. Voice over IP (VoIP) is the current technology in over 70% of new phone system installations. This course teaches the history, components, protocols and deployment of a modern VoIP system. The course will include hands-on labs using industry standard equipment. Prerequisites: NST 103, NST 105, and NST 121 with a grade of “C” or better. 3 credit hours.

**NST 280 T1 Networking I.** Digital carrier theory and operations will be taught in this course and will include carrier transmission, signaling, and power requirements. Also covered will be T1 facilities and the appropriate test procedure for these systems. Discussion will also include D4 type channel banks. 3 credit hours.



**NST 285** T1 Networking II. This course will cover advanced theories and practical applications of installing, testing, and trouble shooting various multiplexers, including D4, SLC-96, and Fiber Light Wave. Prerequisite: NST 280. 3 credit hours.

**NST 292** Fundamentals of Network Security. This course provides an introduction to popular network security tools and practices such as IPSec, CiscoSecure, PIX Firewalls and fundamentals of firewalls, intrusion detection tools, vulnerability scanning and access control in a hands on environment. Prerequisite: NST 202. 6 credit hours.

**NST 299** Special Topics in Networking Systems Technology. Special Topics in Networking Systems Technology (NST) may include instruction on topics not covered in other NST courses. Topics covered in other NST courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**NUCLEAR TECHNOLOGY**  
**RADIATION PROTECTION OPTION**  
**INSTRUMENTATION AND CONTROL OPTION**  
**REACTOR OPERATIONS OPTION**  
**QUALITY CONTROL OPTION**

**41.0205**

*(Associate of Applied Science Degree)*

The Nuclear Technology program offers the student a unique opportunity to obtain state-of-the-art training that will put the graduate in demand by any organization or business that operates nuclear reactors or handles radioactive substances to include advanced manufacturing, life sciences, research reactors, the nuclear power industry, hazardous waste removal companies, and government agencies. Technicians with the educational background this program provides are in high demand now, and with the rising use of radiation in diagnostics, medical treatment and applications, and potential expansion of nuclear power technology this demand will remain high for years to come. Nuclear power is the largest non-carbon source of electricity in the United States providing 20% of the country's power. Job placement prospects are highly favorable and starting salaries reflect this high demand.

The Associate of Applied Science degree program is the only one of its kind in Missouri and one of only a handful in the nation. It was developed cooperatively with the Missouri University Research Reactor, the University of Missouri Nuclear Science and Engineering Institute, AmerenUE Callaway Nuclear Power Plant, and Exelon Nuclear Corporation, all leaders in the nuclear industry.

Enrollment in the Nuclear Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

The core curriculum is designed to follow training requirement guidelines established by the Nuclear Uniform Curriculum Program supported by Nuclear Energy Institute, the Institute of Nuclear Power Operations (INPO), and many nuclear utility companies. The curriculum meets the objectives of the Institute of Nuclear Power Operation's National Academy For Nuclear Training document, ACAD 08-006 Uniform Curriculum Guide for Technician, Maintenance, and Nonlicensed Operations Personnel Associate Degree Programs. The program offers four options which include radiation protection, instrumentation and control, reactor operations, and quality control. An eight-week internship is included as a part of the curriculum in the second year at an approved company.

This program is only offered in Mexico, Missouri, at the Advanced Technology Center.

**Program Mission**

The mission of the Nuclear Technology program is to provide students with the opportunity to develop the technical expertise, math and analytical skills as well as the interpersonal skills required to begin successful careers as nuclear operators, maintenance technicians, radiological protection technicians, or quality control technicians. In addition, students are given the opportunity to earn a nationally recognized National Academy for Nuclear Training certificate validating the student's completion of national nuclear training fundamentals in their respective option.

**Program Goals**

The goals of the program are to provide students the opportunity to develop the skills necessary to:

- Communicate nuclear technology related concepts effectively in both oral and written formats.
- Appraise worksite conditions requiring radiological controls.
- Develop plans for minimizing personnel exposure to radiation.
- Troubleshoot electrical and mechanical equipment.



- Evaluate changing nuclear reactor plant conditions.
- Conduct nuclear work while employing human performance tools to minimize human error.
- Inspect and test nuclear plant systems, structures and components.
- Challenge and inspire students to obtain a National Academy for Nuclear Training certificate.

**CORE CURRICULUM**

			<b>Credit Hours</b>
MNT	101	Time Management	1
MNT	107	Basic Nuclear Math and Theory	4
MNT	189	Reactor Plant Components	4
MNT	197	Basic Reactor Safety, Theory, and Operations	4
MNT	211	Piping and Instrumentation Drawings	2
MNT	290	Internship	4
MAR	101	Introduction to Electricity	4
MAR	110	Mechanical and Fluid Power Transmission	3
COM	211	Technical Writing	3
<b>SUB-TOTAL</b>			<b>29</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)		19
	Must Include: PHY 101/102 College Physics	4
	<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENTS**

			<b>Credit Hours</b>
<b>Radiation Protection Option</b>			
MNT	114	Introduction to Radiation Safety	4
MNT	223	Radiation Detection	4
MNT	233	Radiation Dosimetry	3
MNT	247	Radiation Protection	4
PHY	121	General Chemistry I	5
<b>SUB-TOTAL</b>			<b>20</b>

**OR**

			<b>Credit Hours</b>
<b>Instrumentation and Control Option</b>			
MNT	265	Nuclear Instrumentation and Control I	4
MNT	269	Nuclear Instrumentation and Control II	3
MAR	118	Industrial Motors and their Controls	4
MAR	125	Applied Electronics	4
MAR	204	PLC Programming	4
MAR	218	Computer Interfacing	3
<b>SUB-TOTAL</b>			<b>22</b>

**OR**

			<b>Credit Hours</b>
<b>Reactor Operations Option</b>			
MNT	270	Thermodynamics, Fluid Flow, and Advanced Reactor Theory	5
MNT	274	Reactor Plant Systems	3
MNT	278	Reactor Plant Operations	4



MAR	125	Applied Electronics	4
PHY	121	General Chemistry I	5
		<b>SUB-TOTAL</b>	<b>21</b>
 <b>OR</b>			
		<b>Quality Control Option</b>	
MNT	280	Blueprint Reading, Metrology, and Calibration	2
MNT	282	Codes, Standards, and Regulations	2
MNT	284	Nuclear Industry Preventive and Corrective Actions	2
MNT	286	Advanced Measurement and Testing of Materials	4
MNT	288	Quality Audits	2
MAR	150	Machine Shop Fundamentals	4
		<b>SUB-TOTAL</b>	<b>16</b>
 <b>GRADUATION REQUIREMENT</b>			
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
		 <b>PROGRAM TOTAL</b>	 <b>65-71</b>

**MNT 101 Time Management.** This course includes strategies essential for success in a college and work environment. Skills such as reading, test preparation, test taking, and overall time management techniques are discussed. It is recommended this course be taken during the first semester to provide the student a place in which issues encountered may be addressed, and techniques applied during the entire course of study and beyond. Students will be introduced to the expectations and responsibilities of a nuclear technician. Human performance tools will also be discussed and applied. 1 credit hour.

**MNT 107 Basic Nuclear Math and Theory.** Introduction to basic nuclear concepts using mathematics including dimensional analysis, algebra, geometry, and trigonometry. Additional topics include atomic structure, nuclear reactions, mass to energy conversion, industrial and science applications of nuclear processes, and risk/benefit analysis. Prerequisite: MAT 050 with a grade of “C” or better or SPM 050 with a passing grade or satisfactory placement score into MAT 070. 4 credit hours.

**MNT 114 Introduction to Radiation Safety.** Topics include types of radiation, radioactive decay, activity, radioactive sources, interaction of radiation with matter, radiation units, basic fundamentals of exposure, dose, and personnel dose. The course also includes a basic radiation protection tasks laboratory. Prerequisite: MNT 107. Corequisite: MAT 115. 4 credit hours.

**MNT 189 Reactor Plant Components.** Introduction to basic mechanical and electrical components used by nuclear power plants such as different types of piping, valves, pumps, ejectors, filters, turbines, heat exchangers, compressors, lubrication systems, valve actuators, breakers, transformers, relays, and other equipment. Basic heat transfer, fluid flow, and plant materials theories are included in the course. 4 credit hours.

**MNT 197 Basic Reactor Safety, Theory, and Operations.** Introduction to the fission process, reactivity/criticality, basic reactor kinetics, heat removal, reactor types, nuclear power plant chemistry, and elementary thermodynamics. In addition, basic radiation worker training will be provided in this course. 4 credit hours.

**MNT 211 Piping and Instrumentation Drawings.** Types of piping and instrumentation components, their construction and their schematics; reading of piping and electrical drawings; and lockout/tagout procedures applicable to the nuclear utility industry. Prerequisites: MAR 101 and MNT 189. 2 credit hours.

**MNT 223 Radiation Detection**. Types of detector systems (ionization, Geiger-Muller, proportional counters, liquid and solid scintillation, semiconductor) and their uses, statistics of radioactive decay, systems for radiation detection (NIMBIN systems, preamplifiers, amplifiers, single channel analyzers, multi-channel analyzers), experimental design and measurement, data reduction. Laboratories will include measurement of radioactive decay, measurement of radiation attenuation, utilization of systems for alpha, beta and gamma radiation counting and spectroscopy. Corequisite: MNT 114. 4 credit hours.

**MNT 233 Radiation Dosimetry**. Radiation biology, radiation effects on simple chemical systems, biological molecules, cell, organisms and humans. Stochastic vs. deterministic effects, units of exposure, dose and dose equivalent, external dosimetry, internal dosimetry, control of external and internal exposure, detector and instrumentation systems for measuring dose. Corequisite: MNT 114. 3 credit hours.

**MNT 247 Radiation Protection**. Practical applications and demonstrations of radiation protection and health physics. Radiological survey & analysis instruments, radiation monitoring systems, sample collection equipment, calibration sources and equipment, radiological protection standards, contamination control, monitoring of radiological work, radiological incident evaluation and control, decontamination, radioactive materials control, environmental monitoring. Prerequisites: MNT 223 and MNT 233. 4 credit hours.

**MNT 265 Nuclear Instrumentation and Control I**. Topics include principles of operation of pressure, level, flow, temperature, and radiation detection equipment. Conversion of the inputs via transmitters and transducers to master control systems is also discussed. These input values are then recorded and employ Proportional, Integral, and Derivative (PID) based algorithms to drive key outputs, signal alarms, and calculate error values. Discussion and demonstration of hydraulic, pneumatic, mechanical, and electrical signal transmission is covered in detail. Industry standard calibration techniques per Instrument Society of America (ISA) are studied and demonstrated in hands-on lab exercises. Prerequisite: MNT 189. Corequisite: MAR 204. 4 credit hours.

**MNT 269 Nuclear Instrumentation and Control II**. Topics include in-depth discussion of radiation sensors unique to power generating nuclear reactors. Control systems are discussed with particular emphasis on those found in pressurized and non-pressurized boiler systems. Advanced control theory is introduced, including feed forward and cascade control systems, which are explained and implemented in lab. Use of advanced output techniques such as time proportional control and pulse-width modulation are likewise covered and implemented to control process variables. Includes a technical lab component. Prerequisite: MNT 265. 3 credit hours.

**MNT 270 Thermodynamics, Fluid Flow, and Advanced Reactor Theory**. Topics include properties of steam/water, advanced heat transfer, thermodynamic cycles and efficiency, heat exchanges, fuel cell heat transfer, pump theory and laws, cavitation, and erosion of piping components. Advanced reactor kinetics, heat removal, nuclear power plant chemistry, reactivity calculations, reactor plant materials, reactor sensors, and radiation detectors are also covered. Prerequisites: MNT 189 and MNT 197. 5 credit hours.

**MNT 274 Reactor Plant Systems**. This course covers the purpose, operation, and flow paths of basic reactor systems including many of the systems in ACAD 90-016 Section 7.2. Prerequisites: MNT 189 and MNT 197. 3 credit hours.

**MNT 278 Reactor Plant Operations**. This course covers reactor plant safety design and operation. Basic reactor startup, shutdown, and emergency procedures and why those procedures are written are also covered. Review of past reactor accidents and events. Includes practical laboratory that prepares the student to fulfill the role of Nuclear Equipment Operator. Laboratory will cover practical operating procedures in valve operation, breaker operation, placing equipment on and off of service, lubrication, pump operation, air compressors, diesel engines, and other equipment. Prerequisites: MNT 270 and MNT 274. 4 credit hours.



**MNT 280 Blueprint Reading, Metrology, and Calibration.** This course teaches blueprint reading and interpretation as well as proper use and calibration of measurement and test equipment. Blueprint reading instruction includes symbols, components, and geometric dimensioning and tolerancing (GD&T) terminology. Measurement and test equipment used in this course includes but is not limited to coordinate measuring machines (CMM), electronic measuring devices, gauges, optical tools, force measurement devices, weights, and hardness testing devices. Prerequisite: MAR 150. 2 credit hours.

**MNT 282 Codes, Standards, and Regulations.** An introduction to the controlling codes, standards, and regulations that are used in the nuclear industry including 10 CFR Part 21 and 10 CFR 50 Appendix B, ANSI, ASME, ISO, SAR, Six Sigma, and other applicable standards. 2 credit hours.

**MNT 284 Nuclear Industry Preventive and Corrective Actions.** Students are taught to identify and apply various preventive methods including both design and process failure mode and effects analysis. Elements of corrective action and failure/root cause analysis are discussed. The students will learn to determine whether products or materials meet conformance requirements, use various methods to label and segregate nonconforming materials, and the steps in determining fitness-for-use and product disposition. 2 credit hours.

**MNT 286 Advanced Measurement and Testing of Materials.** This course teaches advanced measurement and testing of materials using various means while concentrating on inspection techniques and processes. Topics include: electrical testing of raceways, cable, conduit and supports; nondestructive testing (NDT) including x-ray, eddy current, ultrasonic, dye penetrant, electromagnetic, and magnetic particle; destructive testing including tensile, fatigue, and flammability; and sampling procedures. Prerequisites: MNT 280 and MNT 282. 4 credit hours.

**MNT 288 Quality Audits.** Basic audit types are taught such as internal, external system, product, and processes. Emphasis is placed on auditing tools and techniques as well as audit preparation, performance, record-keeping, closure, and verification. 2 credit hours.

**MNT 290 Internship.** The student will serve an internship of approximately 320 hours with a company that uses nuclear technicians in radiation protection, nuclear reactor operations, nuclear reactor maintenance or quality control. The student is expected to apply learned skills and training to be a productive employee, and the employer is expected to place the student in an environment that will build on the student's first year of study and enhance the student's knowledge of working in the nuclear industry. Prerequisite: Department Chair approval - GPA of 2.500 or better required. 4 credit hours.

**MNT 299 Special Topics in Nuclear Technology.** Special Topics in Nuclear Technology (MNT) may include instruction on topics not covered in other MNT courses. Topics covered in other MNT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.

**PHY 121 General Chemistry I.** This is an introductory course dealing with the fundamental principles of chemistry. Meets for 3 hours of class and 4 hours of lab each week. Prerequisite: Two years of high school algebra or must be enrolled in or have completed College Algebra. This course is taught by Moberly Area Community College at the Advanced Technology Center in Mexico, Missouri. 5 credit hours.



## **PHYSICAL THERAPIST ASSISTANT**

**51.0806**

*(Associate of Applied Science Degree)*

This program prepares students for a profession as a Physical Therapist Assistant and is accredited by the Commission on Accreditation in Physical Therapy Education, 1111 North Fairfax Street, Alexandria, VA 22314; 703-706-3245; [accreditation@apta.org](mailto:accreditation@apta.org); [www.capteonline.org](http://www.capteonline.org).

The Physical Therapist Assistant (PTA) program is designed to equip the graduate with the necessary skills and training to become employed in various physical therapy settings such as hospitals, rehabilitation facilities, long term care facilities, home health care, clinics or school systems. The program is both physically and mentally challenging. To be successful, students should possess good communication skills and have a good background in science and math.

Linn State Technical College is a member of the Missouri Health Professions Consortium (MHPC) and in partnership with other member colleges is piloting an initiative to expand access for rural Missourians to the Linn State Technical College PTA Program. In conjunction with the consortium, the PTA program is currently offered at Linn State Technical College in Jefferson City and made available via distance technologies to students at Three Rivers Community College in Poplar Bluff and North Central Missouri College in Trenton. All colleges in the MHPC offer and enroll students in the first-year general education and prerequisite coursework. The second-year professional PTA coursework is delivered solely by Linn State Technical College to Three Rivers Community College and North Central Missouri College. Instructional delivery includes traditional on-site classroom instruction, videoconferencing, and web-assisted course management. Lab instruction is provided on-site at Linn State Technical College in Jefferson City, Three Rivers Community College in Poplar Bluff, and North Central Missouri College in Trenton with occasional travel to Jefferson City for testing. Students interested in earning this degree must apply to Linn State Technical College to be considered for admission into the second-year professional PTA portion of the program. Graduates of the program will earn an Associate of Applied Science degree in PTA from Linn State Technical College. A grade of "C" or above must be maintained in all Physical Therapist Assistant courses and the student must successfully complete 640 clock hours of supervised internship in approved clinical facilities.

Enrollment in the Physical Therapist Assistant program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions or [www.linnstate.edu/academic/pta/index.php](http://www.linnstate.edu/academic/pta/index.php) for the specific application requirements, forms, and deadline.

Students who are admitted to the Physical Therapist Assistant program should be aware that they will be subject to drug screening. Criminal background checks will be required prior to clinical placement. Per Missouri law, persons who have been convicted of or pled guilty to certain felony offenses may be prohibited from holding any direct patient care positions. This could prevent placement in and completion of clinical education courses that are required to complete the Physical Therapist Assistant Associate of Applied Science degree.

### **Program Mission**

The Physical Therapist Assistant program prepares competent physical therapist assistants who contribute toward meeting the health care needs of Missourians.

### Program Goals

The goals of the program are to:

- Prepare competent, entry-level physical therapist assistants who will obtain positions and contribute to meeting employment needs in Missouri.
- Provide opportunities for students to develop behaviors and skills sought by employers.
- Furnish opportunities for physical therapist assistant students to develop competencies in communication, professionalism, and leadership.
- Empower students to respond to developing technologies and a dynamic health care environment through a commitment to lifelong learning and service.

### CORE CURRICULUM

			<b>Credit Hours</b>
PTA	101	Introduction to PTA	1
PTA	115	Basic Patient Care Lab	1
PTA	116	Basic Patient Care	2
PTA	117	Documentation for the PTA	1
PTA	118	Functional Anatomy and Kinesiology	3
PTA	119	Functional Anatomy and Kinesiology Lab	1
PTA	120	Physical Agents and Modalities	2
PTA	121	Physical Agents and Modalities Lab	1
PTA	125	Principles of Therapeutic Exercise Lab	1
PTA	128	Health and Disease	3
PTA	135	Clinical Practice I	2
PTA	201	PTA as a Profession	1
PTA	204	Electrotherapeutic Modalities	1
PTA	205	Electrotherapeutic Modalities Lab	1
PTA	209	Orthopedics for the PTA	1
PTA	211	Orthopedics Lab for the PTA	1
PTA	216	Trends and Issues in Physical Therapy	2
PTA	223	Neurological Therapeutic Exercise	3
PTA	224	Neurological Therapeutic Exercise Lab	2
PTA	235	Clinical Practice II	4
PTA	245	Clinical Practice III	4
PTA	289	Research in Physical Therapy	2
		<b>SUB-TOTAL</b>	<b>40</b>

### GENERAL EDUCATION REQUIREMENTS

General Education Requirements (see page 44)			19
		<b>SUB-TOTAL</b>	<b>19</b>

### PROGRAM REQUIREMENTS

ASC	104	Human Anatomy and Physiology w/Lab I	4
ASC	106	Human Anatomy and Physiology w/Lab II	4
ASC	110	Medical Terminology	1
PSY	161	Health Psychology	3
		<b>SUB-TOTAL</b>	<b>12</b>

### GRADUATION REQUIREMENT

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

**PROGRAM TOTAL** **72**



**PTA 101 Introduction to PTA.** This course provides an introduction to the role and scope of practice for the physical therapist/physical therapist assistant (PT/PTA). Students begin to learn legal and ethical concepts guiding professional behavior and conduct, develop an awareness of the health care delivery system, cultural diversity, evidence-based practice, work performance and expectations. Students develop skills in using professional terminology for oral and written communications as well as collaboration with peers in a variety of formats. Integration of learning experiences with concurrent technical courses is used to apply and reinforce knowledge. Prerequisites: Acceptance into the PTA program and ASC 104 and ASC 106 with a grade of “C” or better. 1 credit hour.

**PTA 115 Basic Patient Care Lab.** This lab course provides an introduction to basic physical therapy intervention skills and procedures and provides an opportunity to practice professional behaviors in a lab setting. Principles and concepts pertaining to positioning and draping; body mechanics; transfers; range-of-motion (ROM); aseptic techniques and wound care; bandaging and dressing; vital signs; wheelchairs and patient transporting; gait training; Americans with Disabilities Act (ADA) and massage are included. Prerequisites: Acceptance into the PTA program and ASC 104 and ASC 106 with a grade of “C” or better. Concurrent: PTA 116. 1 credit hour.

**PTA 116 Basic Patient Care.** This lecture course provides an introduction to professional behaviors and basic physical therapy intervention skills procedures, and documentation. Principles and concepts pertaining to positioning, transfers, range-of-motion (ROM), aseptic technique, wound care, bandaging and dressing, vital signs, wheelchairs, gait training, Americans with Disabilities Act (ADA), documentation and massage are included. Prerequisites: Acceptance into the PTA program and ASC 104 and ASC 106 with a grade of “C” or better. Concurrent: PTA 115. 2 credit hours.

**PTA 117 Documentation for the PTA.** This course examines the purposes of documentation and includes the basic skills needed for a physical therapist assistant (PTA) to document patient care. The relationship between documentation and the patient/client management process is examined with emphasis on the role of the PTA in reading the initial documentation and following the plan of care established by the Physical Therapist and documenting on the care provided. The focus is on problem based medical records with integration of medical terminology and abbreviations to enhance clarity and brevity. Prerequisites: PTA 101, PTA 115, PTA 116, PTA 118, PTA 119, and ASC 110 with a grade of “C” or better. 1 credit hour.

**PTA 118 Functional Anatomy and Kinesiology.** This lecture course includes an in-depth study of the structure and function of the musculoskeletal system emphasizing functional aspects of human motion and the biomechanical principles involved. The course also investigates the theoretical basis of various data collection methods including manual muscle testing, goniometric measurements, muscle length, gait and postural assessments, among others. The course incorporates concepts related to the roles of the physical therapist/physical therapist assistant (PT/PTA), use of professional behaviors, and use of appropriate medical language through written and verbal communications. Prerequisites: Acceptance into the PTA program and ASC 104 and ASC 106 with a grade of “C” or better. Concurrent: PTA 119. 3 credit hours.

**PTA 119 Functional Anatomy and Kinesiology Lab.** This lab course provides an introduction to basic physical therapy data collection methods and gives the student the opportunity to practice professional behaviors as well as clinical skills in a lab setting. The student learns principles and procedures related to manual muscle testing, goniometry, muscle length assessment, posture and gait analysis. The application of various concepts related to biomechanics, Newton’s laws of motion, joint structure, the nervous system, and analysis of human motion are also included. The course emphasizes concepts related to the roles of the physical therapist/physical therapist assistant (PT/PTA), use of professional behaviors, and use of appropriate medical language through written and verbal communications. Prerequisites: Acceptance into the PTA program and ASC 104 and ASC 106 with a grade of “C” or better. Concurrent: PTA 118. 1 credit hour.



**PTA 120 Physical Agents and Modalities**. This lecture course provides the physical therapist assistant (PTA) student with theoretical knowledge and practical information about physical agents in rehabilitation. The basic scientific and physiological principles underlying the application of physical agents are explored. Indications, contraindications, and precautions are learned for each modality. Prerequisites: PTA 101, PTA 115, PTA 116, PTA 118, and PTA 119 with a grade of “C” or better. Concurrent: PTA 121. 2 credit hours.

**PTA 121 Physical Agents and Modalities Lab**. This lab course provides the physical therapist assistant (PTA) student with opportunities to practice clinical application skills needed to perform thermal and mechanical treatment modalities used in physical therapy. Emphasis is placed on critical thinking and problem solving to assure that the modality is applied according to the physical therapist’s plan of care and to maximize treatment effectiveness. Safety procedures, indications, contraindications, and precautions are learned and applied for each modality. The student learns to use professional and understandable terminology in written and verbal communication and patient education relative to physical agents. Prerequisites: PTA 101, PTA 115, PTA 116, PTA 118, and PTA 119 with a grade of “C” or better. Concurrent: PTA 120. 1 credit hour.

**PTA 125 Principles of Therapeutic Exercise Lab**. This course introduces the student to the use of exercise as a preventive and treatment mechanism for pathological conditions which influence strength, endurance and flexibility. Students apply principles, design and techniques of therapeutic exercise and functional training. Students will learn to: describe the principles of therapeutic exercise, formulate rationale for the application of and modification of therapeutic exercise, safely and effectively implement therapeutic exercise interventions based on a plan of care established by a physical therapist, measure response to exercise interventions and respond accordingly, demonstrate patient education, and communicate the outcomes of the intervention. Students will learn and practice many types of exercise prior to learning how to apply exercise to specific pathologies. Prerequisites: PTA 101, PTA 115, PTA 116, PTA 118, and PTA 119 with a grade of “C” or better. 1 credit hour.

**PTA 128 Health and Disease**. This course is an investigation of disease processes, pharmacology and medical management of cardiovascular, respiratory, integumentary, urinary, reproductive and endocrine diagnoses commonly seen in physical therapy. The process of inflammation and repair are emphasized. Content includes burns, wounds, peripheral vascular disease and amputation, cancer, and diabetes. As each system is examined, clinical manifestations and the possible physical therapy interventions are reviewed. Prerequisite: PTA 101, PTA 115, PTA 116, PTA 118, and PTA 119 with a grade of “C” or better. 3 credit hours.

**PTA 135 Clinical Practice I**. This is a four week (40 hours per week) clinical experience that provides the student with his/her first opportunity for hands-on patient care. The student will apply basic skills learned in the classroom to the clinical setting making the connection between theory and practice. The student will work under the direct supervision of a licensed physical therapy professional in an assigned/approved facility. This clinical experience provides opportunities for development of appropriate professional behaviors related to the role of the physical therapist assistant (PTA). Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. 2 credit hours.

**PTA 201 PTA as a Profession**. This course provides an introduction to the profession of a physical therapist/physical therapist assistant (PT/PTA) practice. Students learn case-based legal and ethical concepts guiding professional behavior and conduct in the clinical setting and develop an awareness of professional duty, responsibility, and advocacy. Students are introduced to billing and reimbursement methods and issues in various health care settings. Students are directed toward lifelong learning, productivity, and career development planning. Integration of learning experiences with concurrent technical courses is used to apply and reinforce knowledge as well as educate others about the profession of physical therapist assistant (PTA). Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. 1 credit hour.



**PTA 204 Electrotherapeutic Modalities.** This lecture course addresses the basic principles of electricity and electrotherapy. It investigates the basic physical science, the electrophysiology, and the clinical use of physical therapy electrical modalities. Students will learn to recognize common indications, contraindications, and special precautions to the application of electrotherapeutic modalities. Application of electrotherapeutic agents for pain, neuromuscular stimulation, and tissue/wound healing will be studied. Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 205. 1 credit hour.

**PTA 205 Electrotherapeutic Modalities Lab.** This lab course enables the student to gain competency in the safe and effective application of electrical stimulation modalities currently used in physical therapy practice. Indications, contraindications, and precautions are examined and students have opportunities to problem-solve clinical applications to maximize the benefit of the modality. Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 204. 1 credit hour.

**PTA 209 Orthopedics for the PTA.** This lecture course involves an in-depth study of orthopedic conditions, physical therapy data collection, and interventions for orthopedic and cardiopulmonary clients. Previously learned therapeutic exercise techniques are applied to orthopedic and cardiopulmonary conditions, and the relationship between interventions and anatomical structure, function, and pathophysiology are examined. The student reviews the role of the physical therapist assistant (PTA) as a part of the rehabilitation team related to development and delivery of orthopedic therapeutic exercise. Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 211. 1 credit hour.

**PTA 211 Orthopedics Lab for the PTA.** This lab course provides students with opportunities to create and implement therapeutic exercise programs following the physical therapist (PT) plan of care. Students will apply previously learned therapeutic exercise techniques to orthopedic and cardiopulmonary conditions. The student portrays the role of the physical therapist assistant (PTA) as a part of the rehabilitation team related to development and delivery of orthopedic therapeutic exercise with the instructor and/or lab assistant serving as the supervising physical therapist (PT). Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 209. 1 credit hour.

**PTA 216 Trends and Issues in Physical Therapy.** This course utilizes a seminar format to study current issues and trends affecting the physical therapy profession. Student preparation for licensure and PTA practice is enhanced through the use of selected guest speakers in areas pertinent to the profession. Prerequisites: PTA 135, PTA 201, PTA 204, PTA 205, PTA 209, PTA 211, PTA 223, and PTA 224 with a grade of “C” or better. 2 credit hours.

**PTA 223 Neurological Therapeutic Exercise.** This lecture course provides an introduction to the pathology, pathophysiology, medical interventions, testing, and treatments of neurological disease and dysfunction. A general overview of anatomy and physiology of the nervous system as well as adult and pediatric neurologic diseases and dysfunctions signs and symptoms, medical interventions, and specialized testing are included in this course. Principles and concepts pertaining to sensation, perception, motor control, posture, balance, coordination, functional mobility, and ambulation are also included. The student examines theories and techniques of therapeutic intervention commonly used in the treatment of neurologic disease and dysfunction. The course incorporates concepts related to the roles of the physical therapist/physical therapist assistant (PT/PTA), professional behaviors, and the use of appropriate medical language through verbal and written communications. Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 224. 3 credit hours.



**PTA 224 Neurological Therapeutic Exercise Lab.** This lab course provides an introduction to the pathophysiology, medical intervention, and rehabilitation treatment of adult and pediatric neurological disease and dysfunction. Students have the opportunity to practice clinical skills and professional behaviors in a lab setting. Principles and procedures related to motor control, sensation, perception, therapeutic exercise, posture, balance, gait analysis, and gait training are studied using a case-based format. The student explores the role of the physical therapist assistant (PTA) in the treatment of neurological dysfunction, develops effective communication skills for patient/client and family education, and utilizes appropriate medical language through written and verbal communications. Prerequisites: PTA 117, PTA 120, PTA 121, PTA 125, and PTA 128 with a grade of “C” or better. Concurrent: PTA 223. 2 credit hours.

**PTA 235 Clinical Practice II.** This is a six week (40 hours per week) clinical experience that provides the student with opportunities to provide patient care under the supervision of a licensed physical therapy professional in an assigned/approved facility. The student will apply concepts and skills learned in the classroom to the clinical setting, strengthening the connection between theoretical and foundational knowledge. The student will work with a variety of patients to develop competence in clinical skills and exhibit appropriate professional behaviors related to the role of the physical therapist assistant (PTA) as part of the health care team. Prerequisites: PTA 135, PTA 201, PTA 204, PTA 205, PTA 209, PTA 211, PTA 223, and PTA 224 with a grade of “C” or better. 4 credit hours.

**PTA 245 Clinical Practice III.** This is a six week (40 hours per week) clinical experience that provides the student with opportunities to provide patient care under the supervision of a licensed physical therapy professional in an assigned/approved facility. The student will apply concepts and skills learned in the classroom to the clinical setting, strengthening the connection between theoretical and foundational knowledge. The student will work with a variety of patients to develop competence in clinical skills and exhibit appropriate professional behaviors related to the role of the physical therapist assistant (PTA) as part of the health care team. This clinical experience facilitates development of cultural competence, quality assurance, and billing practices. Student will have the opportunity to present and education in-service to the health care team. Prerequisites: PTA 135, PTA 216, and PTA 289 with a grade of “C” or better. 4 credit hours.

**PTA 289 Research in Physical Therapy.** Students explore types and methods of research as well as sources and means of literature review. A thesis statement is developed and students access and analyze evidence-based research to support their thesis. Other methods of acquiring information may entail book review, medical case study, clinical observation, and discussion with physical therapy practitioners. Prerequisites: PTA 135, PTA 201, PTA 204, PTA 205, PTA 209, PTA 211, PTA 223, and PTA 224 with a grade of “C” or better. 2 credit hours.

**PTA 299 Special Topics in Physical Therapist Assistant.** Special Topics in Physical Therapist Assistant (PTA) may include instruction on topics not covered in other PTA courses. Topics covered in other PTA courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**POWERSPORTS TECHNOLOGY**  
**47.0611**  
*(Associate of Applied Science Degree)*

The Powersports Technology program prepares individuals to perform maintenance, troubleshooting, and overhaul of the major components of powersports, outdoor, and marine equipment. Instruction is provided in the classroom on theory, inspection, maintenance, troubleshooting, and repair of wheels, brakes, operating controls, steering, hydraulics, suspension, electrical circuitry, electronic/mechanical engines, manual/automatic shift transmissions, and jet drives. Students gain real-world experience through lab projects and a summer internship.

The program contributes to the green economy by teaching students to work with electric power being used in powersports, outdoor, and marine equipment. Students are also taught about different types of alternative fuels and their impacts on the environment. Biodegradable solvents and other products are used to help reduce water, air, and soil contamination.

Enrollment in the Powersports Technology program is limited and students are selected for this program on a competitive basis. Contact the Office of Admissions for the specific application requirements and deadline.

The Powersports Technology program is accredited by the Equipment & Engine Training Council (EETC) in Two-Stroke and Four-Stroke Gasoline Engines and Electrical. All students will have the opportunity to become certified through EETC in Two-Stroke and Four-Stroke Gasoline Engines and Electrical.

Graduates of the two-year Associate of Applied Science degree program will have the technical competencies required to be productive in an entry-level technician position. Powersports, outdoor, and/or marine employment opportunities include original equipment manufacturer dealers, independent sales and service shops, agriculture-related employers, golf course maintenance shops, and/or government agencies.

It is a graduation requirement of the Powersports Technology (PST) program for students to earn a grade of “C” or better in all “Core Curriculum” courses.

**Program Mission**

The mission of the Powersports Technology program is to provide students with the opportunity to develop the technical and interpersonal skills necessary to succeed in today’s powersports, outdoor, and marine industries.

**Program Goals**

The goals of the program are to provide opportunities for students to develop and demonstrate:

- Electrical knowledge and skills needed to repair and maintain powersports, outdoor, and marine equipment.
- Knowledge and skills necessary to repair, maintain and troubleshoot two-stroke, four-stroke, and diesel engines.
- Knowledge and skills necessary to repair, maintain, and troubleshoot drive train, jet drive, suspension and steering, hydraulic, hydrostat, and brake systems.
- Critical thinking skills used in troubleshooting.
- Oral and written communication skills needed in the industry.



**CORE CURRICULUM**

			<b>Credit Hours</b>
PST	100	Introduction to Powersports Technology	2
PST	110	Preventive Maintenance & Inspection	2
PST	120	Electrical I	2
PST	130	Accessory Systems	2
PST	140	Wheels, Tires, & Brakes	2
PST	145	Frame & Suspension Systems	2
PST	150	Engine I	2
PST	155	Carburetors and Electronic Fuel Injection	2
PST	165	Starting, Ignition, and Charging Systems	2
PST	175	Engine II	2
PST	200	Internship	12
PST	210	Power Transmission, Hydrostatic, and Jet Drive Systems	2
PST	220	Electrical II & Electronics	3
PST	230	Job Estimating, Troubleshooting, & Diagnostics	2
PST	245	Hydraulics	2
PST	260	Service Writer	2
PST	275	Emerging Technologies	2
<b>Optional:</b>			
MTT	196	Machining Essentials (Optional)	(3)
		<b>SUB-TOTAL</b>	<b>45-48</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)			19
Must Include:	COM 111 Oral Communications		3
	PHY 100 Physical Science		4
	OR		
	PHY 103/104 Environmental Science		4
	<b>SUB-TOTAL</b>		<b>19</b>

**PROGRAM REQUIREMENT**

MPT	165	Basic Welding	3
		<b>SUB-TOTAL</b>	<b>3</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Powersports Technology (PST) program for students to earn a grade of “C” or better in all “Core Curriculum” courses.

**PROGRAM TOTAL** **68-71**

**PST 100** Introduction to Powersports Technology. This course introduces and illustrates all components of powersports, outdoor, and marine equipment. Safety, environmental protection, tool usage, fasteners, and gaskets are covered. 2 credit hours.



**PST 110 Preventive Maintenance & Inspection.** This course includes instruction in lubrication and cooling systems of powersports, outdoor, and marine equipment. Students learn how air-cooled and liquid-cooled systems work as well as the major parts of both two-stroke and four-stroke engine lubrication systems and how these systems are serviced. Types and characteristics of motor oil, coolants, gearbox systems, radiator caps, and thermostats are covered. 2 credit hours.

**PST 120 Electrical I.** This course includes instruction in battery, charging, and ignition systems of powersports, outdoor, and marine equipment. The use of electricity to provide the source of starting and operating power as well as the operation and design of common ignition systems are covered. Vacuum, centrifugal advance, half-wave and full-wave rectification, alternators, regulators, batteries, and AC charging systems are included. 2 credit hours.

**PST 130 Accessory Systems.** This course includes instruction in the fundamentals and troubleshooting of accessory systems used on powersports, outdoor, and marine equipment. Lighting systems, warning devices, communication systems, and cruise control are covered. The importance of switches in electrical circuits is emphasized. 2 credit hours.

**PST 140 Wheels, Tires, & Brakes.** This course includes instruction in powersports, outdoor, and marine equipment front and rear wheels, tires, and brake systems. Types of wheels; wheel inspection; repacking wheel bearings; wheel removal, installation, lacing, truing, straightening, balancing, and troubleshooting are covered. Types of tires, tire removal, flat repair, and tire installation are included. Students learn the operating principles of mechanical drum and hydraulic disc brake systems and how inspection, troubleshooting, and repairs are performed. The advantages of anti-lock brake systems (ABS) and linked braking systems (LBS) are explored. 2 credit hours.

**PST 145 Frame & Suspension Systems.** This course includes instruction on powersports, outdoor, and marine equipment frame and suspension system designs and how they affect performance and dependability. Fundamental inspection, service, repair, and troubleshooting procedures on frames and suspension systems are covered. 2 credit hours.

**PST 150 Engine I.** This course includes instruction on two-stroke and four-stroke engines for powersports, outdoor, and marine equipment. Engine parts, installation, initial starting, break-in, inspection, diagnosis, tune-up, general service, reconditioning, and reassembly are covered. Ignition system, fuel system, and valve train adjustments are included. 2 credit hours.

**PST 155 Carburetors and Electronic Fuel Injection.** This course includes instruction in carburetion and electronic fuel injection used in powersports, outdoor, and marine equipment. Students will learn the theory and operation of various types of carburetors as well as electronic fuel injection systems. Carburetors, fuel tanks, manual and electric fuel pumps, sensors, senders, fuel taps, and related tubing are also covered. 2 credit hours.

**PST 165 Starting, Ignition, and Charging Systems.** This course teaches the theories of electric starting systems, breaker point, CDI ignition, and different types of charging systems. The students will also service and troubleshoot alternators, batteries, rectifiers, stators, switches, wiring, regulators, relays, starters, solenoids, schematics, and all components associated with the starting, charging and ignition systems of powersports, outdoor, and marine equipment. Prerequisite: PST 120. 2 credit hours.

**PST 175 Engine II.** This course includes instruction on two-stroke and four-stroke diesel engines for powersports, outdoor, and marine equipment. Engine parts, installation, initial starting, break-in, inspection, diagnosis, tune-up, general service, reconditioning, and reassembly are covered. Ignition system, fuel system, and valve train adjustments are included. Prerequisite: PST 150. 2 credit hours.



**PST 200 Internship.** Students are required to work a minimum of twelve weeks and perform a variety of tasks. Program objectives, students' educational objectives, and employer's on-the-job training capabilities determine internship content and objectives. A training agreement between the employer, the student and the college is required. The student will submit a weekly summary of activities (tasks performed). Prerequisite: Department Chair approval. 12 credit hours.

**PST 210 Power Transmission, Hydrostatic, and Jet Drive Systems.** This course includes powertrains used on light equipment such as powersports, outdoor, and marine equipment. Classroom and lab instruction on components and systems with use and interpreting testing and diagnosing equipment are highly emphasized. Topics include: powertrain theory and principles, clutches, manual transmissions, drive shafts, differentials, final drives, special drives, stern and jet drives, failure analysis, and terminology. 2 credit hours.

**PST 220 Electrical II & Electronics.** This course includes instruction on the safety precautions and knowledge required to service powersports, outdoor, and marine equipment electrical and electronic systems. Electrical and electronic theory, system design and operation, the proper use of test equipment, and the procedures used to diagnose and repair electrical and electronic problems are covered. Prerequisite: PST 120. 3 credit hours.

**PST 230 Job Estimating, Troubleshooting, & Diagnostics.** This course includes instruction on diagnosing and troubleshooting problems and estimating the time and cost involved with repairs of powersports, outdoor, and marine equipment. 2 credit hours.

**PST 245 Hydraulics.** This course teaches the fundamentals of hydraulic circuits as well as how to diagnose and test problem areas. Pumps, motors, valves, and electrical controls are also covered. Schematics are used to understand the function of valves, fluid flow, and electrical control circuits. 2 credit hours.

**PST 260 Service Writer.** This course will teach the basic principles and responsibilities of a service writer's position within the dealership. Topics covered include repair orders, work orders, customer relations, peer relations, warranty work, and networking with other departments within the dealership including the parts and sales departments. 2 credit hours.

**PST 275 Emerging Technologies.** This course introduces students to emerging changes in the powersports, outdoor, and marine industries including changes to minor and major equipment components. Examples of topics that may be studied include modifications and innovations to electrical systems, fuel systems, braking systems, power systems, and steering systems. Prerequisite: Department Chair approval. 2 credit hours.

**PST 299 Special Topics in Powersports Technology.** Special Topics in Powersports Technology (PST) may include instruction on topics not covered in other PST courses. Topics covered in other PST courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.



**WELDING TECHNOLOGY**

**48.0508**

*(Associate of Applied Science Degree and Certificates)*

Welding is the most common way of permanently joining metal parts. In this process, heat is applied to metal pieces, melting and fusing them to form a permanent bond. Because of its strength, welding is used in shipbuilding, automobile manufacturing and repair, aerospace applications, and thousands of other manufacturing activities. Welding also is used to join beams when constructing buildings, bridges, and other structures and to join pipes in pipelines, power plants, and refineries.

The Welding Technology program is structured to be flexible and provide students with the ability to quickly obtain industry certifications while earning college certificates on their way to completing an Associate of Applied Science degree. Students may pursue the following certificates: Less than One Semester Certificate in Basic Welding, One-Year Certificate in Entry-Level Welding, and Less than One Semester Certificate in Advanced-Level Welding.

The program includes instruction to prepare students for NOCTI, AWS SENSE Level I Entry Welder, and/or AWS SENSE Level II Advanced Welder examinations.

It is a graduation requirement of the Welding Technology (WLT) program for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirement” courses.

**Program Mission**

The mission of the Welding Technology program is to prepare students with the skills, knowledge, and attributes required for the completion of the AWS SENSE Level I Entry Welder and/or AWS SENSE Level II Advanced Welder certification and employment in the welding technology field.

**Program Goals**

The goals of the program are to provide students with the opportunity to develop:

- Technical skills and knowledge required for fabrication of precision weldments from ideas, drawings, and blueprints.
- Math skills necessary to compute the required measurements and formula required for accurate fabrication or production of required parts.
- Knowledge and skills necessary to complete American Welding Society (AWS) Schools Excelling through National Skills Standards Education (SENSE) certifications.
- Effective communication and interpersonal skills.
- Analytical and problem solving skills required in the welding industry.
- Work ethic and attitudes that enhance the ability to secure and maintain increasingly meaningful employment.

**WELDING TECHNOLOGY**

**48.0508**

*(Less than One Semester Certificate in Basic Welding)*

Upon successful completion of the Less than One Semester Certificate in Basic Welding the student may choose to pursue a One-Year Certificate in Entry-Level Welding.

**CORE CURRICULUM**

			<b>Credit Hours</b>
WLT	100	Safety and Health of Welders	1
WLT	105	Basic Welding Math	1
WLT	110	Drawing and Welding Symbol Interpretation	1



WLT	115	Welding Inspection and Testing	1
WLT	120	Thermal Cutting Processes I	1
WLT	130	Shielded Metal Arc Welding I	2
WLT	140	Gas Metal Arc Welding I	2
WLT	150	Flux Cored Arc Welding I	2
WLT	160	Gas Tungsten Arc Welding I	2
		<b>SUB-TOTAL</b>	<b>13</b>

**GRADUATION REQUIREMENTS**

BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>

It is a graduation requirement of the Welding Technology (WLT) less than one semester certificate in basic welding for students to earn a grade of “C” or better in all “Core Curriculum” courses.

**PROGRAM TOTAL** **14**

**WELDING TECHNOLOGY**

**48.0508**

*(One-Year Certificate in Entry-Level Welding)*

Upon successful completion of the One-Year Certificate in Entry-Level Welding the student may choose to pursue a Less than One Semester Certificate in Advanced-Level Welding and/or an Associate of Applied Science degree in Welding Technology.

**CORE CURRICULUM**

			<b>Credit Hours</b>
WLT	100	Safety and Health of Welders	1
WLT	105	Basic Welding Math	1
WLT	110	Drawing & Welding Symbol Interpretation	1
WLT	115	Welding Inspection and Testing	1
WLT	120	Thermal Cutting Processes I	1
WLT	125	Thermal Cutting Processes II	1
WLT	130	Shielded Metal Arc Welding I	2
WLT	135	Shielded Metal Arc Welding II	2
WLT	140	Gas Metal Arc Welding I	2
WLT	145	Gas Metal Arc Welding II	2
WLT	150	Flux Cored Arc Welding I	2
WLT	155	Flux Cored Arc Welding II	2
WLT	160	Gas Tungsten Arc Welding I	2
WLT	165	Gas Tungsten Arc Welding II	2
		<b>SUB-TOTAL</b>	<b>22</b>

**GENERAL EDUCATION REQUIREMENTS**

CPP	101	Introduction to Microcomputer Usage	3
OR			
CPP	102	Advanced Microcomputer Usage	
AND			
COM	101	English Composition	3
OR			
COM	110	Honors Composition	
OR			



COM	111	Oral Communications	
OR			
COM	121	Public Speaking	
		<b>SUB-TOTAL</b>	<b>6</b>
<b>PROGRAM REQUIREMENT</b>			
EMS	110	Mathematics for Metalworking	3
		<b>SUB-TOTAL</b>	<b>3</b>
<b>GRADUATION REQUIREMENTS</b>			
BUS	125	Job Search Strategies	1
		<b>SUB-TOTAL</b>	<b>1</b>
<p>It is a graduation requirement of the Welding Technology (WLT) one-year certificate in entry-level welding for students to earn a grade of “C” or better in all “Core Curriculum” and “Program Requirement” courses.</p>			
		<b>PROGRAM TOTAL</b>	<b>32</b>

**WELDING TECHNOLOGY  
48.0508**

*(Less than One Semester Certificate in Advanced-Level Welding)*

Upon successful completion of the Less than One Semester Certificate in Advanced-Level Welding the student may choose to pursue an Associate of Applied Science degree in Welding Technology.

<b>CORE CURRICULUM</b>			<b>Credit Hours</b>
WLT	230	Shielded Metal Arc Welding III	4
WLT	240	Gas Metal Arc Welding III	4
WLT	250	Flux Cored Arc Welding III	4
WLT	260	Gas Tungsten Arc Welding III	4
		<b>SUB-TOTAL</b>	<b>16</b>
<b>GRADUATION REQUIREMENTS</b>			
<b>Optional:</b>			
BUS	125	Job Search Strategies (Optional)	(1)
		<b>SUB-TOTAL</b>	<b>0-1</b>
<p>It is a graduation requirement of the Welding Technology (WLT) less than one semester certificate in advanced-level welding for students to earn a grade of “C” or better in all “Core Curriculum” courses.</p>			
		<b>PROGRAM TOTAL</b>	<b>16-17</b>



**WELDING TECHNOLOGY**

**48.0508**

*(Associate of Applied Science Degree in Welding Technology)*

**CORE CURRICULUM**

			<b>Credit Hours</b>
WLT	100	Safety and Health of Welders	1
WLT	105	Basic Welding Math	1
WLT	110	Drawing & Welding Symbol Interpretation	1
WLT	115	Welding Inspection and Testing	1
WLT	120	Thermal Cutting Processes I	1
WLT	125	Thermal Cutting Processes II	1
WLT	130	Shielded Metal Arc Welding I	2
WLT	135	Shielded Metal Arc Welding II	2
WLT	140	Gas Metal Arc Welding I	2
WLT	145	Gas Metal Arc Welding II	2
WLT	150	Flux Cored Arc Welding I	2
WLT	155	Flux Cored Arc Welding II	2
WLT	160	Gas Tungsten Arc Welding I	2
WLT	165	Gas Tungsten Arc Welding II	2
WLT	230	Shielded Metal Arc Welding III	4
WLT	240	Gas Metal Arc Welding III	4
WLT	250	Flux Cored Arc Welding III	4
WLT	260	Gas Tungsten Arc Welding III	4
<b>SUB-TOTAL</b>			<b>38</b>

**GENERAL EDUCATION REQUIREMENTS**

General Education Requirements (see page 44)	19
<b>SUB-TOTAL</b>	<b>19</b>

**PROGRAM REQUIREMENT**

EMS 110	Mathematics for Metalworking	3
<b>SUB-TOTAL</b>		<b>3</b>

**GRADUATION REQUIREMENTS**

BUS 125	Job Search Strategies	1
<b>SUB-TOTAL</b>		<b>1</b>

It is a graduation requirement of the Welding Technology (WLT) associate of applied science degree program for students to earn a grade of "C" or better in all "Core Curriculum" and "Program Requirement" courses.

**PROGRAM TOTAL** **61**

**WLT 100** Safety and Health of Welders. This course teaches basic understanding of safe operations and practices in the work area, hot zone operation, precautions of working in confined spaces, and safe operation of equipment used for each welding and thermal cutting process. The proper use of personal protective equipment, precautionary labeling, and Material Safety Data Sheet (MSDS) information and inspection are also taught. The use and inspection of ventilation equipment are covered. 1 credit hour.

**WLT 105** Basic Welding Math. This course teaches the basic understanding of the mathematical concepts used in the welding industry. Subjects include metric conversion, angles, decimals, fractions, and areas. 1 credit hour.



**WLT 110** Drawing and Welding Symbol Interpretation. This course teaches the basic knowledge and skills required to interpret basic drawing elements and welding symbols. Additionally, this course covers how to apply this information to the fabrication of components from a drawing. 1 credit hour.

**WLT 115** Welding Inspection and Testing. This course teaches the basic skills and knowledge used to perform visual inspections of edge preparations, finished welds, and weld joint assemblies. Preparing and performing destructive tests on qualification samples are also covered. Various methods of Non-Destructive Testing (NDT) used in the welding industry are introduced. 1 credit hour.

**WLT 120** Thermal Cutting Processes I. This course teaches the basic skills and knowledge required to set-up and operate manual oxy-fuel gas cutting equipment, plasma arc cutting equipment, and air carbon arc equipment as needed for the fabrication and preparation of materials. 1 credit hour.

**WLT 125** Thermal Cutting Processes II. This course provides students with continued development of the skills and knowledge used to set-up and operate manual and mechanized oxy-fuel gas cutting equipment, plasma arc cutting equipment, and air carbon arc equipment as needed for the fabrication and preparation of materials. The course prepares students for the AWS Level I welder performance qualification test. Prerequisite: WLT 120. 1 credit hour.

**WLT 130** Shielded Metal Arc Welding I. This course teaches the basic skills and knowledge required to set-up Shielded Metal Arc Welding (SMAW) equipment, select correct electrodes, identify materials, and perform SMAW operations on carbon steel. 2 credit hours.

**WLT 135** Shielded Metal Arc Welding II. This course provides students with continued development of the skills and knowledge used to set-up Shielded Metal Arc Welding (SMAW) equipment, select correct electrodes, identify materials, and perform SMAW operations on carbon steel. The course prepares students for the AWS Level I welder performance qualification test. Prerequisite: WLT 130. 2 credit hours.

**WLT 140** Gas Metal Arc Welding I. This course teaches the basic skills and knowledge required to set-up Gas Metal Arc Welding (GMAW) equipment, select correct electrodes, identify materials, and perform GMAW operations on carbon steel. 2 credit hours.

**WLT 145** Gas Metal Arc Welding II. This course provides students with continued development of the skills and knowledge used to set-up Gas Metal Arc Welding (GMAW) equipment, select correct electrodes, identify materials, and perform GMAW operations on carbon steel. The course prepares students for the AWS Level I welder performance qualification test. Prerequisite: WLT 140. 2 credit hours.

**WLT 150** Flux Cored Arc Welding I. This course teaches the basic skills and knowledge required to set-up Flux Cored Arc Welding (FCAW) equipment, select correct electrodes, identify materials, and perform FCAW operations on carbon steel. 2 credit hours.

**WLT 155** Flux Cored Arc Welding II. This course provides students with continued development of the skills and knowledge used to set-up Flux Cored Arc Welding (FCAW) equipment, select correct electrodes, identify materials, and perform FCAW operations on carbon steel. The course prepares students for the AWS Level I welder performance qualification test. Prerequisite: WLT 150. 2 credit hours.

**WLT 160** Gas Tungsten Arc Welding I. This course teaches the basic skills and knowledge required to set-up Gas Tungsten Arc Welding (GTAW) equipment, select correct electrodes, identify materials, and perform GTAW operations on carbon steel. 2 credit hours.

**WLT 165** Gas Tungsten Arc Welding II. This course provides students with continued development of the skills and knowledge used to set-up Gas Tungsten Arc Welding (GTAW) equipment, select correct electrodes, identify materials, and perform GTAW operations on carbon steel. The course prepares students for the AWS Level I welder performance qualification test. Prerequisite: WLT 160. 2 credit hours.



**WLT 230** Shielded Metal Arc Welding III. This course teaches advanced Shielded Metal Arc Welding (SMAW) operations on carbon and stainless steel. The course prepares students for the AWS Level II welder performance qualification test. Prerequisites: WLT 135 and AWS SENSE Level I Certification. 4 credit hours.

**WLT 240** Gas Metal Arc Welding III. This course teaches how to use Gas Metal Arc Welding (GMAW) equipment to perform advanced GMAW/GMAW-P operations on aluminum and carbon and stainless steel. The course prepares students for the AWS Level II welder performance qualification test. Prerequisites: WLT 145 and AWS SENSE Level I Certification. 4 credit hours.

**WLT 250** Flux Cored Arc Welding III. This course teaches advanced Flux Cored Arc Welding (FCAW) operations on carbon steel. The course prepares students for the AWS Level II welder performance qualification test. Prerequisites: WLT 155 and AWS SENSE Level I Certification. 4 credit hours.

**WLT 260** Gas Tungsten Arc Welding III. This course teaches advanced Gas Tungsten Arc Welding (GTAW/GTAW-P) operations on aluminum and carbon and stainless steel. The course prepares students for the AWS Level II welder performance qualification test. Prerequisites: WLT 165 and AWS SENSE Level I Certification. 4 credit hours.

**WLT 299** Special Topics in Welding Technology. Special Topics in Welding Technology (WLT) may include instruction on topics not covered in other WLT courses. Topics covered in other WLT courses may also be covered in more depth in this special topics course. Projects may be undertaken in any area related to the major program with credit hours determined by the level and amount of involvement. The minimum involvement required for one credit is 30 contact hours. The specific topic(s), objectives, plan of instruction, and evaluation criteria must be documented in the syllabus; approved by the Department/Division Chair; and filed in the Academic Records Office. Students may complete more than one Special Topics course, provided that the credits earned in this manner do not exceed a total of four (4) credits. 1-4 credit hours.