

ELECTRONICS AND COMPUTER TECHNOLOGY I

Electronics and Computer Technology I introduces students to the fundamental electronic concepts necessary for entry into an electronic and computer systems career pathway, which will culminate with industry certifications or additional post-secondary education. Classroom and laboratory experiences will allow students to begin their career preparation in the fundamental electronics concepts of Jobsite Skills, DC Basics, AC Basics, and Personal Computer Design, and will incorporate safety, technical writing, mathematical concepts, and customer service.

- DOE Code: 5684
- Recommended Grade Level: Grade 11-12
- Recommended Prerequisites: Introduction to Advanced Manufacturing
- Credits: 2-3 credits per semester, 6 credits maximum.
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- This course is aligned with postsecondary courses for Dual Credit:
 - Ivy Tech
 - EECT 101- Intro to Electronics & Projects
 - EECT 111- Intro to Circuits Analysis
 - Vincennes University
 - ELEC 100- Basic Electricity & Electronics
 - ELEC 110-Basic Component & Circuit Analysis

Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

Career and Technical Student Organizations (CTSOs)

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in SkillsUSA, the CTSO for this area.

Content Standards

Domain –Careers

Core Standard 1 Students analyze career and employment trends in Electronics and Computer Technology to prepare for future employment opportunity

Standards

- ECTI-1.1 Understand the importance of electronics and computers in the 21st century
- ECTI-1.2 Recognize and explain the convergence of technologies
- ECTI-1.3 Investigate various careers associated with electronics and computer technology
- ECTI-1.4 Differentiate between the training and certification needed for different careers
- ECTI-1.5 Compare the advancement opportunities in various careers
- ECTI-1.6 Demonstrate project management skills

Domain –Safety

Core Standard 2 Students apply concepts of safety as outlined in professional and governmental regulation to ensure personal and workplace security.

Standards

- ECTI-2.1 Assess tools and hazards that are associated with technician activities in the workplace
- ECTI-2.2 Examine ladder handling, usage, and height safety concepts as outlined by OSHA
- ECTI-2.3 Recognize service vehicle safety concerns such as transporting ladders, securing equipment and materials, and providing driver screens inside the vehicle
- ECTI-2.4 Utilize lockout and tagging rules for potentially unsafe electrical or mechanical hazards
- ECTI-2.5 Recognize personal safety precautions for working with electrical and electronic devices
- ECTI-2.6 Examine the human physiological reactions electrical shock causes
- ECTI-2.7 Break down various degrees of current the human body can tolerate
- ECTI-2.8 Explain the concept of First Aid and its particular importance to workers in electric and electronic fields
- ECTI-2.9 Compare the different classes of fires (A, B, C & D) and the type of fire extinguishers used to fight them
- ECTI-2.10 Research fire safety regulations as specified by National Electrical Code (NEC) and National Fire Protection Association (NFPA) 70
- ECTI-2.11 Determine fiber optics hazards to skin and eyes
- ECTI-2.12 Outline the safety precautions to be taken when working with diodes, transistors, thyristors, integrated circuits, optoelectronic devices, power supplies, amplifiers, operational amplifiers, oscillators, and wave-shaping circuits
- ECTI-2.13 Examine static causes and CMS damage prevention straps, mats, and grounding technology

Domain – Soldering, De-soldering And Tools

Core Standard 3 Students select the appropriate process and tools to perform soldering-desoldering operations.

Standards

- ECTI-3.1 Recognize solder safety as it pertains to burns and potential fires or damage to facilities or customer products
- ECTI-3.2 Diagnose the cause of solder fumes and the effects of lead poisoning
- ECTI-3.3 Examine causes and precautions to prevent or reduce solder splatter
- ECTI-3.4 Outline the reasons for flux usage and describe types

- ECTI-3.5 Compare types of solder and explain reasons for choosing each type
- ECTI-3.6 Classify heat shunts and explain why and how they are used
- ECTI-3.7 Recognize cold solder joints and explain the causes
- ECTI-3.8 Contrast the differences between good and bad mechanical and electrical solder connections
- ECTI-3.9 Demonstrate proper care of solder and de-solder equipment and aids
- ECTI-3.10 Assess de-soldering principles
- ECTI-3.11 Compare various types of de-soldering equipment and how they are used
- ECTI-3.12 Utilize braid-wick solder removers

Domain – DC Basics: Electrical Theory

Core Standard 4 Students analyze basic electrical theory to apply concepts in equipment repair and maintenance.

Standards

- ECTI-4.1 Interpret the scientific symbols and metric prefixes used in DC electronics
- ECTI-4.2 Recognize the following electronic measurements and their application to DC electronics: current, voltage, resistance, and power
- ECTI-4.3 Determine electronic components and their usage: resistors, insulators, conductors, switches, fuses, circuit breakers, and batteries
- ECTI-4.4 Select appropriate tools for electronics troubleshooting
- ECTI-4.5 Interpret electronic schematic diagrams
- ECTI-4.6 Examine basic electrical and magnetic properties and their relation to various materials
- ECTI-4.7 Examine multimeter components and usage
- ECTI-4.8 Distinguish wire types and construction
- ECTI-4.9 Examine wire gauges and identify specific purposes for each wire gauge
- ECTI-4.10 List common identifications for copper cables such as #18, #24, and UTP telephone cable
- ECTI-4.11 Differentiate between various cable types
- ECTI-4.12 Convert fixed numbers to scientific notation
- ECTI-4.13 Demonstrate standard metric conversion
- ECTI-4.14 Examine Ohms Law and its applications in calculating current, voltage, or resistance
- ECTI-4.15 Outline the characteristics of DC resistance
- ECTI-4.16 Differentiate between various circuits including series, parallel, combination, loaded voltage divider and Wheatstone bridge circuits

Domain – AC Basics: Principles Of Alternating Current

Core Standard 5 Students examine AC wave form characteristics and applications to apply concepts in equipment repair and maintenance.

Standards

- ECTI-5.1 Examine AC wave form characteristics: effective voltage (RMS), average voltage, negative alternation, positive alternation, wavelength, amplitude, and period
- ECTI-5.2 Calculate peak, RMS, and average voltage values for an AC wave form
- ECTI-5.3 Identify the frequency terms: cycle, hertz, and phase
- ECTI-5.4 Quote Ohms Law power, voltage, current, and resistance formulas. Solve for circuit

values

- ECTI-5.5 Compare capacitor types; list common usages and methods of varying capacitance
- ECTI-5.6 Compare inductor types and reasons for various core materials
- ECTI-5.7 Recognize common types of transformers and list uses for each; explain why laminations are used
- ECTI-5.8 Describe the requirement for inductance in AC electrical circuits identifying the difference between self and mutual inductance
- ECTI-5.9 Examine Lenz's law in complement with Faraday's law of induction
- ECTI-5.10 Deduce the factors used in calculating inductance for a single and multi-layer air core coil
- ECTI-5.11 Contrast the differences between reactance and resistance and describe current/voltage relationships
- ECTI-5.12 Compare impedance with reactance and resistance; explain the causes and effects of impedance
- ECTI-5.13 Calculate power consumption and requirements in inductors in AC circuits
- ECTI-5.14 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current, and power
- ECTI-5.15 Show the different purposes for capacitors and list common types and construction of the different types
- ECTI-5.16 Contrast the differences between capacitive reactance and resistance; describe current/voltage relationships
- ECTI-5.17 Explain phase relationships of voltage and current for series and parallel RL, RC, and RCL circuits
- ECTI-5.18 Examine bandwidth and selectivity for series and parallel resonant circuits
- ECTI-5.19 Diagram the component configurations used in PI, L, and T type high and low pass filter circuits

Domain – Circuit Analysis: Analog Devices and Circuits - Optional

Core Standard 6 Students verify circuits and their components ensuring proper operation within various electronic products.

- ECTI-6.1 Describe the purpose and use of diodes
- ECTI-6.2 Recognize the common types of diodes and their schematic symbols
- ECTI-6.3 Describe the purpose and types of a transistor
- ECTI-6.4 Identify schematic symbols and leads of a transistor
- ECTI-6.5 Describe NPN and PNP transistor bias
- ECTI-6.6 Describe the purpose of an amplifier
- ECTI-6.7 Describe classes of amplifier operation including CE, CC, and CB amplifiers
- ECTI-6.8 Examine multistage, RC coupled, Push-Pull and FET transistor amplifiers
- ECTI-6.9 Describe the purpose of transformers
- ECTI-6.10 Identify transformer schematic symbols
- ECTI-6.11 Describe transformer operating characteristics
- ECTI-6.12 Calculate turns ratio, secondary voltage, primary and secondary current and power
- ECTI-6.13 Examine power supplies and rectifiers

- ECTI-6.14 Investigate Half Wave, Full Wave and Bridge rectifier operation
- ECTI-6.15 Examine Zener diode and IC voltage regulator operation
- ECTI-6.16 Examine various types of Oscillators and Multivibrator circuits
- ECTI-6.17 Investigate various types of trigger circuits including Unijunction transistors, SCRs, Diacs, Triacs and 4 layer diodes
- ECTI-6.18 Describe the types operational amplifiers

Domain – Personal Computer Design – Optional

Core Standard 7 Students apply and adapt computer disassembly/assembly procedures to perform various computer troubleshooting, repair and maintenance services.

Standards

- ECTI-7.1 Using common practice hand tools, assemble and disassemble a personal computer
- ECTI-7.2 Using common practice software and test equipment, troubleshoot and identify malfunctions on computer motherboards, secondary storage devices, and power supplies
- ECTI-7.3 Examine the theory of operation, characteristics, and use of system memory
- ECTI-7.4 Examine the theory of operation, characteristics, and use of the various buses used in computers
- ECTI-7.5 Outline the categories of System Resources theory of operation and their use
- ECTI-7.6 Explain the theory of operation, types, characteristics, and use of microprocessors
- ECTI-7.7 Examine the operation, characteristics, and use of peripheral devices commonly used with computer systems
- ECTI-7.8 Troubleshoot and identify malfunctions on peripheral devices commonly used with computer systems using common practice software and test equipment
- ECTI-7.9 Examine the operation, characteristics, and use of current operating systems
- ECTI-7.10 Examine the operation and design of laptops and notebooks
- ECTI-7.11 Describe the theory of operation and characteristics of File Management systems that are currently in use with computers
- ECTI-7.12 Explain the term “Integrated high voltage transformer” supply; explain how it differs from direct and other power supply types
- ECTI-7.13 Describe basic computer networking topologies and protocols
- ECTI-7.14 Compare and Contrast various common word processing systems with emphasis on specific hot keys
- ECTI-7.15 Outline SCSI, termination, and SCSI IDs
- ECTI-7.16 Flow Chart General Purpose I/O
- ECTI-7.17 Outline Internet Applications

Domain – Electronics Systems Technician (EST) – Optional

Core Standard 8 Students apply and adapt low voltage wiring procedures to ensure proper installation of residential and commercial electronic systems.

Standards

- ECTI-8.1 Recognize differences between AC and DC to promote safety, efficiency, and quality on a job/project
- ECTI-8.2 Recognize differences between low-voltage and line voltage to promote safety,

- efficiency, and quality on the job
- ECTI-8.3 Identify the four basic units of measurement used with electricity, and explain how they relate in Ohm's Law
 - ECTI-8.4 Interpret construction drawings and symbols on drawings, to promote safety, productivity, and quality on a job/project
 - ECTI-8.5 Outline the various types of documentation tools and methods used on a job/project. to promote safety, productivity, and quality
 - ECTI-8.6 Identify hand and power tools and their uses, storage, and maintenance to promote safety, productivity, and quality on a job/project.
 - ECTI-8.7 Distinguish between various tools and test equipment and identify their uses, storage, and maintenance to promote safety, productivity, and quality on a job/project
 - ECTI-8.8 Recognize and explain various construction methods and materials used to promote safety, productivity, and quality on a job/project
 - ECTI-8.9 Select appropriate wire and cable materials to complete specific jobs/projects
 - ECTI-8.10 Identify termination types, pin-out configuration, wire preparation and termination techniques and connection points on cables and equipment to promote safety, efficiency, accuracy and quality on a job/project
 - ECTI-8.11 Identify color code standards for telephony, speakers, data, and video to promote safety, efficiency, and quality on a job/project
 - ECTI-8.12 Compare various fasteners, anchors and back boxes used to mount cable and other equipment to structures to promote safety, efficiency, and quality on the job
 - ECTI-8.13 Break down installation techniques and procedures to promote quality, efficiency, and safety on the job/project
 - ECTI-8.14 Examine accepted standards and best practices
 - ECTI-8.15 Recognize and explain applicable building codes and safety practices

Domain – Robotics – Optional

Core Standard 9 Students analyze robotic concepts to explore design processes and procedures.

Standards

- ECTI-9.3 Determine how signals are sent when controlling a robot
- ECTI-9.2 Measure how much current a robot draws
- ECTI-9.3 Determine how much a motor will lift
- ECTI-9.4 Assess how gear ratios affect speed and torque
- ECTI-9.5 Design, build, and test a gear train
- ECTI-9.6 Determine if wheel size matters
- ECTI-9.7 Examine the use and design of sensors in a robot
- ECTI-9.8 Examine the role and use of encoders
- ECTI-9.9 Program a robot to perform various tasks
- ECTI-9.10 Distinguish between tele-operated (remote control) and autonomous devices
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Domain – Mobile Electronics – Optional

Core Standard 10 Students evaluate various mobile electronics systems to ensure proper installation and

service.

Standards

ECTI-10.1 Distinguish between various mobile electronic equipment

ECTI-10.2 Demonstrate audio component installation techniques

ECTI-10.3 Examine audio installation components and techniques

ECTI-10.4 Outline security System Architecture

ECTI-10.5 Describe mobile navigation systems

ECTI-10.6 Introduction to Mobile video systems and remote control start