ELECTRONICS AND COMPUTER TECHNOLOGY II

Electronics and Computer Technology II provides the opportunity for students to continue with foundational electronic concepts including circuit analysis and digital electronics modules. After completing the two additional foundational modules, student may choose to focus on one of the optional modules that can include more intense instruction, research, specialized projects, and internships. The optional modules include industrial technology, emerging electronic technologies, residential and commercial electronic communication, and automation. The content of this class is designed to provide the State of Indiana with a trained workforce in emerging technologies career pathways that will make a significant contribution to the Indiana economy. Industry certifications and additional post-secondary education are critical components of this pathway. Classroom, laboratory, and work-based experiences in the fundamental electronics concepts of circuit analysis and digital electronics as well as one of the optional modules will incorporate safety, technical writing, mathematics, and customer service.

- DOE Code: 5694
- Recommended Grade Level: Grade 12
- Recommended Prerequisites: Electronics and Computer Technology I
- Credits: 2-3 credits per semester, maximum of 6 credits
- 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:
  - Vincennes University
    - ELEC 130- Digital Electronics
  - Ivy Tech
    - EECT 112- Digital Fundamentals
    - EECT 121- Electronics Circuits 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 – Basic Safety For Electronics And Computer Technology II

Core Standard 1 Students apply and adapt basic electrical safety practices to ensure professional and governmental compliance.

Standards

ECTII-1.1 List tools and hazards that are associated with technician activities in the workplace
ECTII-1.2 List ladder handling, usage, and height safety rules as outlined by OSHA
ECTII-1.3 List service vehicle safety concerns such as transporting ladders, securing equipment and materials, and providing driver screens inside the vehicle
ECTII-1.4 Describe lockout and tagging rules for potentially unsafe electrical or mechanical hazards
ECTII-1.5 Describe personal safety precautions for working with electrical and electronic devices
ECTII-1.6 Describe the human physiological reactions electrical shock causes
ECTII-1.7 List various degrees of current the human body can tolerate
ECTII-1.8 Explain the concept of First Aid and its particular importance to workers in electric and electronic fields
ECTII-1.9 List and explain fire safety regulations as specified by National Electrical Code (NEC) and National Fire Protection Association (NFPA) 70 – To include understanding the different classes of fires and extinguishers used to fight them
ECTII-1.10 List fiber optics hazards to skin and eyes
ECTII-1.11 Explain the reasons for safety in the following areas: electrical and electronic safety, electrostatic discharge (ESD), electromagnetic interference (EMI), fire safety, physical safety, fiber optics cable, magnets, CD-ROM safety and maintenance issues
ECTII-1.12 List 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
ECTII-1.13 Employ skills necessary to differentiate among investigative typologies including offenses, offenders and victims

Domain – Digital Electronics

Core Standard 2 Students analyze the workings and configurations of digital design and circuitry.

Standards

ECTII-2.1 Compare and contrast between 1 and 0; high and low; +5 and ground; and truth and false logic levels
ECTII-2.2 Identify and convert numbers between the decimal, binary, octal, and hexadecimal and BCD number systems
ECTII-2.3 Identify and describe the function of AND, OR, Inverter, NAND, NOR, Buffer, Exclusive OR and Exclusive NOR gates
ECTII-2.4 Understand the uses for logic test probes
ECTII-2.5 Create truth tables from design specifications and logic expressions
ECTII-2.6 Create a logic expression and truth table from an AOI circuit
ECTII-2.7 Develop an un-simplified logic expression from a truth table
ECTII-2.8 Explain Boolean Algebra and its use in digital circuitry
ECTII-2.9 Simplify a logic expression using the rules and laws of Boolean Algebra including DeMorgan's
ECTII-2.10 Simplify un-simplified logic expressions containing two, three, or four variable K-Maps
ECTII-2.11 Compare and contrast a logic design using AOI, NAND, and NOR type combinational logic circuits
ECTII-2.12 Determine the solution that uses the least number of ICs between AOI, NAND, and NOR type logic circuits
ECTII-2.13 Identify the difference between a Common Cathode (CC) and Common Anode (CA) seven segment display
ECTII-2.14 Select the correct current limiting resistor for a seven segment display
ECTII-2.15 Design half-adders and full-adders using combinational logic gates
ECTII-2.16 Know the various type of gate packages; SSI, MSI, LSI, and VLSI
ECTII-2.17 Design circuits using multiplexers and de-multiplexers
ECTII-2.18 Use the two's complement process to add and subtract binary numbers
ECTII-2.19 Design a circuit and understand the advantages and disadvantages of using a Programmable Logic Device (PLD)
ECTII-2.20 Describe the functions of the RS, D and JK type flip-flops
ECTII-2.21 Know the difference between the synchronous and asynchronous inputs of a flip-flop
ECTII-2.22 Describe the timing diagram of each type of flip-flop
ECTII-2.23 Describe counter and register characteristics
ECTII-2.24 Explain wave shaping circuits and explaining their purposes
ECTII-2.25 Analyze up, down and modulus asynchronous and synchronous counters
ECTII-2.26 Know how to design counters and registers using SSI combinational gates and MSI integrated ICs
ECTII-2.27 Analyze flip-flop applications such as event detectors, shift registers and frequency dividers
ECTII-2.28 Apply a programming software such as Quartus to program a VHDL device to test the operation and timing diagrams of a variety of basic logic circuits

Domain—Introduction to Computer Networking – Optional
Core Standard 3 Students compare and contrast various computer networking systems to ensure proper installation and optimum network performance.

Standards
ECTII-3.1 Explain the function of common networking protocols
ECTII-3.2 Identify address formats and commonly use TCP and UDP default ports
ECTII-3.3 Identity common IPv4 and IPv6 routing protocols
ECTII-3.4 Compare the characteristics of wireless communication standards
ECTII-3.5 Categorize standard cable types and their properties
ECTII-3.6 Identify common connector types
ECTII-3.7 Identify and explain common physical network topologies
ECTII-3.8 Categorize LAN and WAN technology types and properties
ECTII-3.9 Configure and differentiate between common network devices
ECTII-3.10 Identify the functions of specialized network devices
ECTII-3.11 Explain the advanced features of a switch
ECTII-3.12 Explain the function of each layer of the OSI model
ECTII-3.13 Explain the different methods and rationales for network performance
ECTII-3.14 Explain the purpose of network scanners
ECTII-3.15 Explain the function of hardware and software security devices
ECTII-3.16 Explain the methods of network access security and common features of a firewall
ECTII-3.17 Explain methods of user authentication and issues that affect device security
ECTII-3.18 Identify common security threats and mitigation techniques

Domain—Pre-Wiring the Structure – Optional
Core Standard 4 Students integrate wiring concepts into residential and commercial electronics installation procedures to ensure all installed system components work per industry specifications

Standards
ECTII-4.1 Describe the task of roughing-in new structures, installing wall boxes, conduit, distribution boxes, speaker in-wall units, CCTV mounts, etc.
ECTII-4.2 Explain the use of wall plates and indicate proper locations
ECTII-4.3 Describe purposes and locations for J-Hooks and cable trays
ECTII-4.4 Explain inductive signals and interference, their effects and precautions and separation distances for cabling
ECTII-4.5 Outline the purposes of wiring, labeling, sizing, and all factors effecting wiring installation
ECTII-4.6 Explain methods used to closely estimate cable requirements for individual applications
ECTII-4.7 Formalize a termination standard for RJ-45 connections
ECTII-4.8 Select a device to distribute audio and video throughout the house
ECTII-4.9 Lay out wiring configuration for a multi-camera surveillance system
ECTII-4.10 Demonstrate calculations using the Power Formula and Ohm’s Law
ECTII-4.11 Explain the purpose of electric circuit grounding and NEC rules for residences
ECTII-4.12 Describe lightning hazards, lightning arrestors used in electronics applications and how ground blocks are used
ECTII-4.13 Diagram a basic telephone circuit
ECTII-4.14 Differentiate between Internet – Cable TV- Wireless Systems and B-VoIP
ECTII-4.15 Explain bar coding and modern inventory control methods for residences
ECTII-4.16 Explain manual, automatic, and programmable appliances control
ECTII-4.17 Explain how energy management can control the overall load on the electrical grid
ECTII-4.18 Describe the types of installation documents and drawings used for successful installation of low voltage systems (floor plans, RCP, elevations, schedules)
ECTII-4.19 Explain the Divide and Conquer troubleshooting method
ECTII-4.20 List common problems and solutions in cabling
ECTII-4.21 Identify sources of on-line and phone technical help from product makers and suppliers
ECTII-4.22 Explain time or event automatic control operation
ECTII-4.23 Describe the advantages of interfacing the network with the heating, ventilation and cooling system of the home
ECTII-4.24 Describe why and how home events data may be accessed
ECTII-4.25 Explain how event sequences can be incorporated into a home control system and the advantages
ECTII-4.26 Describe how programmable logic control (PLC) is utilized in home control systems

Domain—Residential Wiring - Optional
Core Standard 5 Students analyze the workings and configurations of residential electrical wiring.

Standards
ECTII-5.1 Describe electrical symbols and conductors
ECTII-5.2 Describe electrical wiring systems and boxes
ECTII-5.3 Understand switches, interrupters and suppressors
ECTII-5.4 Describe recessed lighting and ballast
ECTII-5.5 Understand branch circuits and conductor sizing
ECTII-5.6 Describe bedroom/master bedroom circuits
ECTII-5.7 Describe bath, hallway, front porch, and entry circuits
ECTII-5.8 Understand kitchen, dining area, and living room circuits
ECTII-5.9 Describe laundry, study, rear entrance, and attic circuits
ECTII-5.10 Describe family room and garage circuits
ECTII-5.11 Describe workshop circuits and basement circuits
ECTII-5.12 Describe water pump and heater circuits
ECTII-5.13 Understand large kitchen appliance circuits
ECTII-5.14 Understand vent fan and hydromassage circuits
ECTII-5.15 Describe electric heating and air conditioning wiring circuits
ECTII-5.16 Understand oil/gas heating and heat/smoke detectors
ECTII-5.17 Describe television and telephone signal distribution systems
ECTII-5.18 Understand entrance equipment and calculations
ECTII-5.19 Understand pools, spa and smart house wiring
ECTII-5.20 Understand remote control systems

Domain—Alternative Energy: Photovoltaic - Optional
Core Standard 6 Students analyze the workings and configurations of photovoltaic alternative energy systems.

ECTII-6.1 Identify major components of a Photovoltaic System
ECTII-6.2 Identify types of PV systems
ECTII-6.3 Identify panel types and characteristics
ECTII-6.4 Determine proper installation sequence for Array and BOS
ECTII-6.5 Install basic Array and BOS components
ECTII-6.6 Determine proper Array orientation
ECTII-6.7 Understand basic performance characteristics
ECTII-6.8 Understand basic systems sizing methods
ECTII-6.9 Troubleshoot basic systems problems and installations errors
ECTII-6.10 Understand safe working practices for: Working aloft (ladder, roof, lanyard and harness)
ECTII-6.11 Understand safe working practices for: Working with hand and basic power tools
ECTII-6.12 Understand safe working practices for: Eye and ear protection
ECTII-6.13 Understand safe working practices for: Electrical safety

**Domain**—Alternative Energy: Small Wind Energy Generation - Optional

**Core Standard 7** Students analyze the workings and configurations of small wind alternative energy systems.

ECTII-7.1 Identify major components of a Small Wind System
ECTII-7.2 Identify types of SW systems
ECTII-7.3 Identify mounting and turbine types and characteristics
ECTII-7.4 Determine proper installation for turbine types
ECTII-7.5 Install basic small wind turbine components
ECTII-7.6 Determine proper site location
ECTII-7.7 Understand basic performance characteristics
ECTII-7.8 Understand basic systems sizing methods
ECTII-7.9 Troubleshoot basic systems problems and installation errors
ECTII-7.10 Understand safe working practices for: Tower safety
ECTII-7.11 Understand safe working practices for: Working aloft (ladder, roof, lanyard and harness)
ECTII-7.12 Understand safe working practices for: Working with hand and basic power tools
ECTII-7.13 Understand safe working practices for: Eye and ear protection
ECTII-7.14 Understand safe working practices for: Electrical safety