

**Career-Technical Credit Transfer (CT)²
Electrical Engineering Technology Career-Technical Assurance Guide (CTAG)
June 22, 2019**

The following courses, indicated by a Career-Technical Articulation Number (CTAN), are eligible for post-secondary credit and transfer among Ohio's public secondary career-technical institutions and state institutions of higher education. The SCTAI alignment document with ODE competencies and post-secondary learning outcomes are available on the ODHE website at <https://www.ohiohighered.org/sctai/ctags>.

CTEET001 - DC Circuits (OET001)	Credits: 3 Semester Hours
<p>Advising Notes: To access post-secondary college credit for this CTAN, secondary students must:</p> <ul style="list-style-type: none"> • Students must matriculate to an institution of higher education with an approved or comparable program within 3 years of completing the approved secondary program. • Students must successfully complete the ODE course DC Electronic Circuits (175105) with a qualifying cut score of 61 or higher on the End-of-Course examination from an approved high school program. • Students must include proof of laboratory component with their submission. • Students must complete the pre-requisite requirement for College Algebra at the matriculating institution. <ul style="list-style-type: none"> ○ Students will not receive post-secondary credit for DC Circuits until this pre-requisite is satisfied. <p>To access college credit for this CTAN, adult career-technical students from Ohio Technical Centers must:</p> <ul style="list-style-type: none"> • Successfully complete an approved Electronics (CT)² program at an Ohio Technical Center. • Complete the pre-requisite requirement for College Algebra at the matriculating institution <ul style="list-style-type: none"> ○ Students will not receive credit for DC Circuits until this pre-requisite is satisfied. <p>For CTAG credit, please consult the TAG Rubric for DC Circuits developed by the OETEA. This document will help both instructors and students understand the level to which the CTAG learning outcomes shall be taught and understood.</p>	<p>Secondary institutions must have pathway approval from the Ohio Department of Education. Certificate of Affirmation assurances are now incorporated into the CTE-26 application process.</p>

CTEET002 - Digital Electronics (OET002)	Credits: 4 Semester Hours
<p>Advising Notes: To access post-secondary college credit for this CTAN, secondary students must:</p> <ul style="list-style-type: none"> • Students must matriculate to an institution of higher education with an approved or comparable program within 3 years of completing the approved secondary program. • Students must successfully complete the ODE course [Digital Electronics (175007)] with a score of 56 or higher on the End-of-Course examination. • Students must include proof of laboratory component with their submission. <p>For CTAG credit, please consult the TAG Rubric for Digital Electronics developed by the OETEA. This document will help both instructors and students understand the level to which the CTAG learning outcomes shall be taught and understood.</p>	<p>Secondary institutions must have pathway approval from the Ohio Department of Education. Certificate of Affirmation assurances are now incorporated into the CTE-26 application process.</p>
CTEET003 - Programmable Logic Controllers (OET022)	Credits: 3 Semester Hours
<p>Advising Notes: To access post-secondary college credit for this CTAN, secondary students must:</p> <ul style="list-style-type: none"> • Matriculate to an institution of higher education with an approved or comparable program within 3 years of completing the approved secondary program. • Successfully complete ODE Course [Industrial Robotics (176025)] • Submitted course work must include proof of a laboratory component. <p>To access college credit for this CTAN, adult career-technical students from Ohio Technical Centers must fulfill the following conditions:</p> <ul style="list-style-type: none"> • Successfully complete an approved (CT)² program at an Ohio Technical Center. <p>For CTAG credit, please consult the CTAG Rubric for Programmable Logic Controllers developed by the OETEA. This document will help both instructors and students understand the level to which the CTAG learning outcomes shall be taught and understood.</p>	<p>Secondary institutions must have pathway approval from the Ohio Department of Education. Certificate of Affirmation assurances are now incorporated into the CTE-26 application process.</p>

Each CTAN identifies the learning outcomes equivalent or common to those taught in introductory technical courses. To receive credit under these agreements, the career-technical programs and the state institutions of higher education must document that their course content matches the learning outcomes in the CTANs.

Requirements and Credit Conditions:

General Notes and Student Guidance:

1. The receiving institution must have a comparable program, major, or courses for the CTANs listed in this document. [Approved programs can be found here.](#)
2. Credits apply to courses in the specified technical area at Ohio's public institutions of higher education, if the institution offers courses in the specific technical area. In the absence of an equivalent course, and when the institution offers the technical program, the receiving institution will guarantee to grant and apply an equivalent credit value of the Career-Technical Articulation Number (CTAN) toward the technical requirements of the specific degree/certificate program.
3. A career-technical student seeking credit under the terms of this CTAG must enroll in the college and submit the verification form within three years of completing a career-technical education course.
4. A career-technical student who meets all eligibility criteria will receive the credit hour value for the equivalent course(s) as offered at the receiving state institution of higher education.
5. The admission requirements of individual institutions and/or programs are unaffected by the implementation of (CT)² outcomes.
6. The transfer of credit through this CTAG will not exempt a student from the residency requirements at the receiving institution.

General Course Description: A detailed study of direct current electric circuits and related bilateral devices. This course covers DC fundamentals, the systems that use them, and the basic sources of DC electricity. Conventional and computer circuit analysis will be used. Includes hands-on labs.

Credits: 3 Semester Hours

Learning Outcomes:

1. * Demonstrate an understanding of, and application for, electrical components and quantities
2. * Define voltage, current, electrical resistance and power
3. * Utilize Ohm's Law and Kirchhoff's Laws to analyze circuits.
4. * Determine resistance, current, voltage, and power for series circuits, parallel circuits, and series-parallel circuits.
5. * Apply circuit theorems such as superposition, Thevenin's and Norton's theorems to the analysis of circuits.
6. * Employ mesh and/or nodal analysis techniques to analyzing circuits.
7. * Demonstrate an understanding of the properties of capacitors and their behavior under DC conditions.
8. * Demonstrate an understanding of the properties of inductors and their behavior under DC conditions.

****Asterisk Indicates Essential Learning Outcomes***

General Course Description: Principles and applications of digital systems. Emphasis placed on the study of combinational and sequential logic from a systems approach. Actual ICs and Programmable logic devices (PLDs) are used, as well as digital timing diagrams and waveforms. Includes hands-on labs.

Credits: 3-4 Semester Hours

Learning Outcomes:

1. * Demonstrate an understanding of and application for number systems, operations, and codes.
2. * Identify various types of Logic Gates and explain their truth tables.
3. * Utilize Boolean Algebra to describe and simplify digital logic circuits.
4. * Apply DeMorgan's theorem to simplify combinational logic circuits.
5. * Design combination logic circuits to meet specified system requirements.
6. * Demonstrate an Understand of and applications for Encoders / Decoders.
7. * Demonstrate an understanding of and applications for multiplexers/demultiplexers.
8. * Demonstrate an understanding of and applications for adders, subtractors, and Arithmetic Logic Units (ALUs).
9. * Explain the types of, operation of, and applications for flip-flops and related devices.
10. * Demonstrate an understanding of and applications for counters.
11. * Demonstrate an understanding of and applications for shift registers.
12. * Utilize and explain the types of memory and storage in digital circuits.
13. * Explain the development of and applications for Integrated circuit technologies.

****Asterisk Indicates Essential Learning Outcomes***

General Course Description: This course includes the principles and application of Programmable Logic Controllers including ladder logic, program control, data manipulation, math instructions, sequencers, shift registers, networking, PLC-mechanism interfacing and human-machine interfacing. Students will install, program, and document PLCs used in a variety of applications. The course will include advanced control circuits, advanced design of ladder and wiring diagrams to meet a given set of criteria, PLC programming, development of a human-machine interface, and data transfer in PLC networks. Includes hands-on lab.

Credits: 3 Semester Hours**Learning Outcomes:**

1. * Recall the history of control systems and Programmable logic controllers (PLCs).
2. * Explain and describe the use of number systems.
3. * Demonstrate use of ladder logic programming devices.
4. * Employ ladder logic use in control circuit design.
5. * Use addressing to control Input/Output (I/O) modules.
6. * Demonstrate the use of relays, contacts, coils, and timers.
7. * Demonstrate counters and sequencers.
8. * Demonstrate fundamental PLC programming (e.g. comparators, block transfers, I/O forcing).
9. * Demonstrate data transfer in PLC networks.

****Asterisk Indicates Essential Learning Outcomes***

Electrical Engineering Technology Panel Participants

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