Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: ELEC102 **Year: 2024-2025**

Course Title: Introduction to Electronics and Embedded Programing **Credit Hours: 4**

I. Course Description: This course is designed for students interested in Electrical Engineering and Electrical Engineering Technology. It provides a theoretical overview of key electrical and electronics components used in modern electronics. Additionally, students will learn general computer programming concepts and more specific ones used in embedded programming for microcontrollers, circuit simulator CAD software, soldering techniques, and other electronics measuring equipment. Through hands-on learning, students will build, program, and troubleshoot various electrical circuits controlled by an Arduino microcontroller. No prior knowledge in electronics or programming is required for this course. Prerequisites: None. 4 Credits (3 Lec. 3 Lab). Fall and Spring Semesters.

II. Additional Course Information:

1. ELEC102 is a required course in the Electrical Engineering Technology pathway of the Applied Science and Technology A.A.S as well as the Electrical Engineering Technician Level I credential at Tompkins Cortland Community College.
2. This course satisfies a technical elective requirement for the Applied Science and Technology A.A.S.
3. A lab fee of $90 or more will be charged for this course.
4. The lab component requires handling sensitive electronic equipment and fine motor skills.
5. TINA and other engineering CAD software are used in this course.
6. This course consists of at least 150 minutes of lecture and 150 minutes of lab work each week for the fifteen-week semester.
7. The ELEGOO MEGA 2560 THE MOST COMPLETE STARTER KIT is issued in the first week of classes to each student. Students must bring the kit to every class. The kit is students' to keep at the end of the course.

III. Student Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Identify key electrical and electronics components used in modern electronics; read and explain schematics of electronic circuits; identify all parts of a given circuit.
2. Learn general computer programming concepts and more specific ones used in embedded programming for microcontrollers.
3. Build and troubleshoot various electrical circuits controlled by a microcontroller.
4. Generate a technical report documenting the principles of operation of hardware and software.

IV. Tompkins Cortland Institutional Learning Outcomes; Program Learning Outcomes; SUNY General Education Outcomes

Tompkins Cortland ILOs

Complete this section for "service" courses only (e.g. courses that are required of all students; courses that are not program specific but satisfy liberal arts requirements; or commonly used in multiple academic programs to meet non-program-specific requirements). Check only Institutional Learning Outcomes (ILOs) that are meaningfully developed and assessed in this course. For each ILO chosen, include the SLO to which it aligns.

Students will:

☐ Communicate effectively, in oral and written forms, taking into consideration audience and purpose.

☐ Apply principles and methods of scientific inquiry and quantitative reasoning appropriate to their discipline.

☐ Use information, critical thinking, and the creative process to solve problems and reach conclusions.

☐ Use technology appropriate to their discipline.

☐ Describe the ways in which social, economic, or environmental sustainability depends on their own and the collective contributions of a diversity of ideas and people.

Program Learning Outcomes

Complete this section for program-specific courses (e.g. those that share the same 4 letter designation as the academic program or satisfy requirements in related programs). List the academic program(s) here and note which Student Learning Outcomes align to specific Programmatic Learning Outcomes. Please see the MCS Instructions for more details.

Specify the Academic Program
Applied Science and Technology A.A.S.

Upon successful completion of this program, a student should be able to demonstrate:

PLO#3 The ability to communicate effectively (using both the spoken and written word) within the technologies;
- SLO#4 Generate a technical report documenting the principles of operation of hardware and software.

PLO#5 Practice of professional skills as applied to a technical area of expertise
- SLO#1 Identify key electrical and electronics components used in modern electronics; read and explain schematics of electronic circuits; identify all parts of a given circuit.
- SLO#2 Learn general computer programming concepts and more specific ones used in embedded programming for microcontrollers.
- SLO#3 Build and troubleshoot various electrical circuits controlled by a microcontroller.

SUNY General Education Outcomes

If this course **assesses** a SUNY GEN ED Outcome, check all that apply and indicate which course outcome(s) address each checked item:

☐ CRITICAL THINKING - Students will:

a. identify, analyze, and evaluate arguments as they occur in their own or others' work; and
b. develop well-reasoned arguments.

☐ INFORMATION MANAGEMENT - Students will:

a. perform the basic operations of personal computer use;

b. understand and use basic research techniques; and
c. locate, evaluate and synthesize information from a variety of sources.

☐ GENERAL EDUCATION CATEGORY - Area(s):
For courses that are approved to meet one (or more) of the ten SUNY General Education categories, indicate which category the course fulfills, and which outcome(s) are aligned with the SUNY outcomes for that category:

☐ This course does not address any of the above Tompkins Cortland ILOs, PLOs, or SUNY General Education Outcomes.

V. Essential Topics/Themes

1. Arduino Boards and Programming
2. Electrical Circuits Components
3. Digital I/O
4. Buzzers (Active/Passive)
5. Sensors (Ultrasonic, Temp. & Humidity, Passive Infrared, Accel/Gyro, Water-Level Detection)
6. Displays (Single / Four Digit 7-segment, LCD)
7. Soldering
8. Motors (Servo, Stepper)
9. Embedded programming throughout course content: Variables, Initialization, Decision-making Statements, Loops, Functions, Arrays, Code Optimization Techniques.
10. Addressed throughout the course are also the following topics: Logic and Logic Circuits, Boolean Variables, Schematics of Electronic Circuits, Flow Charts, Ohm's Law
11. CAD software for building and simulating the AC / DC / Transient response of electrical and digital circuits.

VI. Methods of Assessment/Evaluation

Method	**% Course Grade**
1. Quizzes	25-50%
2. Final Exam or Final Project	20-30%
3. Lab Reports and Lab Performance	30-50%
4. Assignments	10-20%

VII. Texts – ☐ Required ☒ Recommended ☐ Used for more than one course (list courses)

1. Elegoo Mega 2560 The Most Complete Starter Kit Support Files https://www.elegoo.com/pages/arduino-kits-support-files
2. Mathematics for Electricity and Electronics, 4th Edition, Arthur Kramer, Delmar Cengage Learning
3. The Basic Soldering Guide Handbook: Learn to Solder Electronics Successfully, Alan Winstanley, Antex Electronics Limited.

Editions listed are current as of date of syllabus. More recent editions may be used.

VIII. Bibliography of Supplemental Materials

1. *Mathematics for Machine Technology*, 8th Edition, Peterson & Smith, Cengage
2. *Quality Hand Soldering and Circuit Board Repair*, 5th Edition, H. Ted Smith, Delmar Cengage Learning
3. Arduino Education, https://www.arduino.cc/en/Tutorial/HomePage

Editions listed are current as of date of syllabus. More recent editions may be used.

IX. Other Learning Resources

Audiovisual: None specified

Electronic: Arduino Education, https://www.arduino.cc/en/Tutorial/HomePage
TINA, https://www.tina.com/
MS Visio, https://www.microsoft.com/en-us/microsoft-365/visio/flowchart-software/

Other:

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for academic adjustments. All course materials are available in alternate formats upon request.*

Academic Integrity: *Every student at Tompkins Cortland Community College is expected to act in an academically honest fashion in all aspects of their academic work: in writing papers and reports, in taking examinations, in performing laboratory experiments and reporting the results, in clinical and cooperative learning experiences, and in attending to paperwork such as registration forms.*
Any written work submitted by a student must be their own. If the student uses the words or ideas of someone else, they must cite the source by such means as a footnote. Our guiding principle is that any honest evaluation of a student's performance must be based on that student's work. Any action taken by a student that would result in misrepresentation of someone else's work or actions as the student's own — such as cheating on a test, submitting for credit a paper written by another person, or forging an advisor's signature — is intellectually dishonest and deserving of censure.
Several degree programs offer student learning opportunities (such as internships, field work, and clinical experiences) outside the standard classroom setting. As part of the learning process, students must understand and engage in conduct that adheres to principles guiding employment within the professional workplace. These behaviors include, but are not limited to, academic integrity, accountability, reliability, respect, use of appropriate language and dress, civility, professional ethics, honesty, and trustworthiness. Disciplinary action may be initiated for inappropriate conduct occurring while participating in any course-related project or event.