Course Number and Title: ELC 227 Microcontroller Fundamentals

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2022-51

Prerequisite:
ELC 125, ELC 127, CEN 180

Co-Requisites:
none

Course Credits and Hours:
3.00 credits
2.00 lecture hours/week
3.00 lab hours/week

Course Description:
This course presents concepts and hands-on experience necessary to understand the architecture and software associated with microcontrollers. Structured laboratory exercises include assembly and high level programming, interrupt management, and peripheral interfacing.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
TI-84+ or TI-89 calculator, Electronics parts kit

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Explain the architecture of a microprocessor or microcontroller. (CCC 1, 2, 3, 6; PGC 1, 2, 3, 4)
2. Explain memory systems and their interface to a microprocessor or microcontroller. (CCC 1, 2, 3; PGC 1, 2, 3, 4)
3. Develop well-designed programs to solve engineering problems. (CCC 1, 2, 3, 6; PGC 1, 2, 3, 4)
4. Interface input/output devices to communicate between the microcontroller and its associated peripheral devices. (CCC 1, 2, 3, 6; PGC 1, 2, 3, 4)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Explain the architecture of a microprocessor or microcontroller.
    1. Describe the similarities and differences between microprocessors and microcontrollers and their applications.
    2. Diagram the system and computer architecture of a microprocessor and microcontroller.
    3. Summarize the features of the essential components for the architecture of a microcontroller.
    4. Generate a programmer's model of a processor, and describe the function of each register.
    5. Identify and explain the different types of busses.
    6. Discuss cost/performance trade-offs of different bus and interface architectures.
2. Explain memory systems and their interface to a microprocessor or microcontroller.
    1. Define *binary data units*.
    2. Explain how memory units are organized.
    3. Identify and explain the various types of read-only memory devices.
    4. Identify and explain the various types of random access memory.
    5. Identify and explain the various types of flash memory.
    6. Identify and explain special types of memory devices such as first-in first-out (FIFO), last-in first-out (LIFO), magnetic, and optical storage.
    7. Provide guidelines to use of various types of memory devices.
    8. Describe the advantages and disadvantages of using different storage media.
    9. Generate a memory map to indicate how the memory is structured in the processor.
3. Develop well-designed programs to solve engineering problems.
    1. Identify and explain types of instructions used in microcontroller programming.
    2. Develop well-designed and documented programs using the microcontroller's addressing modes and instruction set.
    3. Develop well-designed and documented high-level language programs.
    4. Interpret how the assembly code generated by a compiler relates to the high level program code.
    5. Create time delay subroutines.
    6. Perform programming tasks that involve conditional and unconditional branching and looping.
    7. Create service routines to perform a function on the occurrence of a hardware or software interrupt.
    8. Predict, measure, and manipulate a program's execution time.
    9. Illustrate program logic and flow by creating flowcharts.
    10. Use an integrated development environment (IDE) as a modern software tool for application development.
    11. Test and debug software programs.
4. Interface input/output devices to communicate between the microcontroller and its associated peripheral devices.
    1. Explain input/output (I/O) and interrupt operations in a microcontroller.
    2. Compare and contrast different types of analog-to-digital (A/D) and digital–to-analog (D/A) converters.
    3. Interface I/O devices to the microcontroller.
    4. Write programs to perform I/O using handshaking and interrupts.
    5. Use a microprocessor or microcontroller to collect and process data signals from sensors and produce an output signal.

Evaluation Criteria/Policies:
The grade will be determined using the Delaware Tech grading system:

90	–	100	=	A
80	–	89	=	B
70	–	79	=	C
0	–	69	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Final Course Grade:
Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Summative: 3-4 Exams (equally weighted)	50%
Formative: 8-12 Laboratory Experiments (equally weighted)	30%
Summative: Ethics Essay	5%
Summative: Research Paper / Professional Development	5%
Summative: Final Project	10%
TOTAL	100%

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Apply a knowledge of mathematics, science, engineering, and technology to electronics engineering technology problems that require limited application of principles but extensive practical knowledge.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Identify, analyze and solve narrowly defined electronics engineering technology problems.
5. Explain the importance of engaging in self-directed continuing professional development.
6. Demonstrate basic management, organizational, and leadership skills which commit to quality, timeliness and continuous improvement.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.