COURSE INFORMATION

Course Prefix/Number: EET 251
Course Title: Microprocessor Fundamentals
Lecture Hours/Week: 3.0
Lab Hours/Week: 3.0
Credit Hours/Semester: 4.0

VA Statement/Distance Learning Attendance
Textbook Information
Student Code and Grievance Policy
Attendance Statement (3-30-4000.1)

COURSE DESCRIPTION

This course is a study of binary numbers; micro-processor operation, architecture, instruction sets, and interfacing with operating systems; and applications in control, data acquisition, and data reduction and analysis. Programs are written and tested.

COURSE COMPETENCIES

Upon successful completion of this course, the student should be competent to perform the following tasks:

Module 1: Microcomputer Basic Concepts
- Convert from one number system to another: decimal, binary, and hex
- Identify basic computer architecture, Motorola 68HC11 architecture
- Describe the HC11 registers, memory map, and input/output (I/O)
- Describe the HC11 Evaluation Board and Monitors (BUFFALO and Wytec Phantom)
- Use Programming concepts such as machine, assembly, and HC11 mnemonics
- Identify HC11 memory addressing modes, CCR status flags, and data movement instructions–load, store, clear, transfer, and exchange

Module 2: HC11 Programming
- Use Arithmetic instructions – add, BCD add, increment, subtract, negate, and decrement in simple programs
- Use Logic instructions – AND, OR, EOR, and COM; and shift/rotate instructions in simple programs
- Use Multiply and Divide instructions, flag manipulation instructions. Relative addressing and branch instructions in simple programs
- Use Program Loops and Loop Instructions. Indexed addressing in depth in simple programs
Module 3: Subroutine Processing and HC11 Memory Systems, I/O, and Interrupt Operation

- Use Subroutine Processing – Stack Concept, Push and Pull Instructions
- Use Branching to and Returning from Subroutine, and Parameter Passing
- Identify HC11 Memory Systems – HC11 Memory Map, On-chip Memory, System Registers, and Memory Expansion
- Identify and use HC11 General Purpose I/O: Port B Output Operation, Port C Programmable I/O Operation, I/O with Handshaking, I/O on Ports A, D, and E
- Identify and use HC11 Interrupts and Reset – CCR Control Bits, Interrupt Servicing, Interrupt Control, Maskable Interrupts, Nonmaskable Interrupt, Resets and Reset Servicing

Module 4: HC11 Analog Capture, Timer Operations, and Serial Communication

- Use the HC11 (Port E) for Analog Capture and Analog-to-Digital Conversion
- Use the Port A Timing System – Theory of Timed Events, Main Timer Functions, Input Capture, Output Compare, Pulse Accumulator, Real-Time Interrupts
- Discuss the use of Serial Communication and Port D – Theory of Serial Communications
- Discuss the use of the Serial Communication Interface (SCI), Serial Peripheral Interface (SPI)

MINIMAL STANDARDS/PERFORMANCE OBJECTIVES

The following competencies may be measured by: a written or oral exam, or an written or oral report.

Module 1: Microcomputer Basic Concepts

- Given a number in any base, the student should be able to convert the number to any other base with 90% accuracy.
- Given a binary number, the student should be able to employ the number as unsigned or signed with 90% accuracy.
- Given a microcomputer reference manual, the students should be able to identify the architectural features and comprehend the instruction mnemonics with 90% accuracy.

Module 2: HC11 Programming

- Given a microcomputer instruction set reference manual, the student should be able design simple algorithms for programming with 90% accuracy.
- Given a programming problem requiring iteration, the student should be able to design a loop structure with the given microcomputer instruction set with 90% accuracy.

Module 3: Subroutine Processing and HC11 Memory Systems, I/O, and Interrupt Operation

- Given a programming situation, the student should be able to structure the main and sub routines with 80% accuracy.
- Given a microcomputer reference manual, the student should be able to describe the memory map and memory addressing scheme with 90% accuracy.
- Given a microcomputer reference manual, the student should be able to identify the ports and their functional features and be able to design a simple digital I/O with 85% accuracy.
- Given a microcomputer reference manual, the student should be able to describe the interrupt structure and levels with 80% accuracy.
Module 4: HC11 Analog Capture, Timer Operations, and Serial Communication

- Given a microcomputer reference manual, the student should be able to design systems to interface an analog signal to the system with 80% accuracy.
- Given a microcomputer reference manual, the student should be able to describe the timer system options with 80% accuracy.
- Given a microcomputer reference manual, the student should be able to describe the serial communication options with 80% accuracy.

COURSE REQUIREMENTS

Students are responsible for attaining competencies through completion of the following course requirements:

Hybrid Course
If this is a hybrid/online course, students are expected to check in daily for any communication via email, calendar and/or the bulletin board. Students who do not check in for two weeks running will be dropped from the course. Students are expected to attend any labs or review sessions held by the instructor. If a student misses a test because of illness or urgent emergency, then he/she should do the following: Notify the instructor at the earliest possible date. At that time a new date for the make-up test will be scheduled. Students with unexcused absences when a test is given will be allowed to take a make-up test at the discretion of the instructor. The student has the responsibility to be sure that some arrangement is made with the instructor for taking a make-up test.

Missing Class
In case a student does miss a class, he/she is responsible for obtaining the material that was covered during the absence. If a student is aware that he/she will miss a class, then the student should notify the instructor at the earliest possible date.

Missing Lab
In case a student does miss a lab, he/she is responsible for completing the lab as soon as possible (preferably before the test covering the lab material). The lab will have to be made up on the students own time.

Missing a Test
If a student misses a test because of illness or urgent emergency, then he/she should notify the instructor prior to the class period, or at the earliest possible date. At that time a new date for the make-up test will be scheduled. Students with unexcused absences during test will be allowed to take a make-up test at the discretion of the instructor. The student has the burden to be sure that some arrangement is made with the instructor for taking a makeup test.

Participation in Class
Students will be expected to participate in class discussions, to demonstrate problem-solving techniques, to complete tests, homework, lab experiments, lab reports and other assigned work.

Lab Requirements
During laboratory experiments, the students may work in teams of two or individually if space permits. Students must demonstrate to the instructor that the circuit is working correctly before they leave. All assigned lab work must be completed before the student leaves the lab unless prior arrangements are made with the lab instructor.
Students will be asked to demonstrate mastery of the competencies outlined in the section on COURSE COMPETENCIES and again in the section on MINIMAL STANDARDS/PERFORMANCE OBJECTIVES. This demonstration will in the form of a lab exam given to each individual student. Students may repeat the lab exam once. Students must achieve a 90% score after the repeat. To demonstrate communication skills, at least one laboratory report must be written formally and submitted with the lab books as part of the lab requirements. This report or reports will be given the same weight as each of the other lab experiments. The requirements for the reports will include the following:

- Be computer generated using available word processing packages in the electronics or computer labs or a home computer.
- Be contained in a standard size, solid color cover with fasteners.
- Student’s name, course number and semester will be written on the cover.
- If more than one lab report is required, all may be contained within the same folder.
- Follow the format guidelines given by the instructor. In general, each lab report should contain the following: date of experiment, title, objectives, equipment list, schematic diagrams, procedures, data tables, sample calculations, any graphs generated by the lab, and conclusions. The conclusion should restate the objectives of the lab and whether the objectives were met. A comparison between the measured and computed values should also be included with explanation of errors greater than 5%.
- Be neat, concise, readable and written using correct English grammar. A rubric for grading is attached to this document

**Evaluation**

Lab reports will be evaluated based on readability, accuracy, and whether it contains all necessary parts. A rubric for grading lab reports is attached

**Academic Integrity**

The policies stated in the York Technical College Handbook will be enforced. Any student violating these policies will be subject to academic discipline.

**EVALUATION STRATEGIES/GRADING**

The grading scale will be as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
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<tbody>
<tr>
<td>A</td>
<td>90 - 100</td>
</tr>
<tr>
<td>B</td>
<td>80 - 89</td>
</tr>
<tr>
<td>C</td>
<td>70 - 79</td>
</tr>
<tr>
<td>D</td>
<td>60 - 69</td>
</tr>
<tr>
<td>F</td>
<td>Below 60</td>
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</tbody>
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**Evaluation Method**

*Unless otherwise stated:*

Tests may be written or oral and may contain questions that are true or false, short answer, multiple choice, fill in the blank and/or problems.

Each Module will carry equal weight. Each test within each module will carry equal weight. Each lab and report within a module will carry equal weight.
Each module will be assigned a grade as follows:
   Tests (Average, Minimum 1).................................60%
   Lab Experiments/Reports (Average, Minimum 1).........20%
   Instructor Options .............................................10%
   Work Ethics* ......................................................10%

*Work ethics is defines as:
   • Attendance
   • Ethical Behavior
   • Participation
   • Quality
   • Perseverance
   • Safety
   • Team Work
   • Respect for Others
   • Cooperation
   • Timeliness

The instructor options will be discussed with the students during the first week of class. These options may include homework, spot quizzes or written reports. A rubric for grading “Instructor Options” will be given at the time of the assignment.

ENTRY LEVEL SKILLS

Students should possess basic electrical laboratory and measurement techniques. Required computer skills include simple Windows operations.

PREREQUISITES

EET 141 and CPE 107 or equivalent

CO-REQUISITES

EET 145

DISABILITIES STATEMENT

Any student who feels s/he may need an accommodation based on the impact of a disability should contact the Special Resources Office (SRO) at 803-327-8007 in the 300 area of Student Services. The SRO coordinates reasonable accommodations for students with documented disabilities.