Course Number & Name: ELC 228 Introduction to Microprocessors

Credit Hours: 4.0  Contact Hours: 6.0  Lecture: 3.0  Lab: 3.0  Other: N/A

Prerequisites: Grade of “C” or better in ELC 218

Co-requisites: None  Concurrent Courses: None

Course Outline Revision Date: Fall 2010

Course Description: This is an introductory course in microprocessor applications for students who already have basic knowledge of digital circuits principles. Computer hardware organization is analyzed, and machine-language programs are written and run. Hardware and software aspects of a popular eight-bit microprocessor are studied in detail. Theoretical ideas are reinforced by building and testing realistic experimental systems in the laboratory.

Course Goals: Upon successful completion of this course, students should be able to do the following:

1. assemble, test, analyze, and troubleshoot microprocessor-based systems;
2. use a microprocessor system and modify its design as necessary; and
3. function effectively on teams.

Measurable Course Performance Objectives (MPOs): Upon successful completion of this course, students should specifically be able to do the following:

1. Assemble, test, analyze, and troubleshoot microprocessor-based systems:
   1.1 identify and explain the architecture of a basic computer;
   1.2 interpret and write computer programs in an assembly language;
   1.3 interpret and write computer programs in a machine language; and
   1.4 interpret the manufacturer’s specification sheets relating to digital components

2. Use a microprocessor system and modify its design as necessary:
   2.1 use a popular microprocessor to control logical processes;
   2.2 test and troubleshoot both the hardware and software components of a microprocessor system to arrive at microprocessor-based solutions to practical problems; and
   2.3 interface a popular microprocessor with simple peripheral devices
Measurable Course Performance Objectives (MPOs) (continued):

3. Function effectively on teams:
   3.1 identify the role of each member in a group for the term project;
   3.2 collaborate to achieve the objectives of the term project;
   3.3 share openly and willingly with the team;
   3.4 treat others in a respectful and supportive manner; and
   3.5 communicate effectively.

Methods of Instruction: Instruction will consist of a combination of lectures, class discussions, classroom demonstrations, laboratory experiments, board work, group work and individual study.

Outcomes Assessment: Quiz, test, and exam questions are blueprinted to course objectives. Checklist rubrics are used to evaluate the laboratory reports for the presence of course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

Course Requirements: All students are required to:

1. Maintain regular attendance and participate in classroom discussions.
2. Complete homework assignments, lab reports, and the term project on time.
3. Sit for all quizzes, tests, and exams as scheduled.
4. Read all assigned textbook pages.

Methods of Evaluation: Final course grades will be computed as follows:

<table>
<thead>
<tr>
<th>Grading Components</th>
<th>% of final course grade</th>
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<tbody>
<tr>
<td>Homework, quizzes, class participation, and attendance</td>
<td>25 – 30%</td>
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<td>A perusal of homework problems and quizzes and an analysis of class discussion will indicate the extent to which students master course objectives.</td>
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<tr>
<td>Term Project</td>
<td>20 – 25%</td>
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<td>Over the semester, students will work in groups of two to assemble and test a sing board computer from scratch. This term project will show evidence of applying course concepts to real world problems, designing a solution, functioning effectively on teams, and composing a technical report.</td>
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Methods of Evaluation (continued):

<table>
<thead>
<tr>
<th>Grading Components</th>
<th>% of final course grade</th>
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<tr>
<td>• Midterm Exam</td>
<td>20 – 25%</td>
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<td></td>
<td>The midterm exam will show evidence of the extent to which students meet course objectives, including but not limited to identifying and applying concepts, analyzing and solving problems, estimating and interpreting results and stating appropriate conclusions using correct terminology, based on course material covered during the first half of the semester.</td>
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<tr>
<td>• Final Exam (comprehensive)</td>
<td>25 – 30%</td>
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<td>The same objectives apply as with the Midterm Exam, but it is anticipated that students will provide increased evidence of synthesizing a combination of concepts covered throughout the semester.</td>
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**NOTE:** The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

- plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
- cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
- interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
- fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.
**Course Content Outline:** based on the text *MM-8000 Micro-Master 8085 Microprocessor – Basic Systems Course*; published by Elenco Electronics Inc, 2008

<table>
<thead>
<tr>
<th>Week</th>
<th>Content/Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Review of Number Systems: Binary, Hexadecimal, Decimal, and BCD</td>
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</table>
| 2    | Address-Data Bus  
**Lab 1:** Assembly of DC Power Distribution System and 8 LED Indicators |
| 3    | Random Access Memory (RAM), Address Latch Enable (ALE), Read from Memory (RD), Write to Memory (WR), Input Output/Memory (IO/M), Enable RAM (ENRAM), Reset (RS)  
**Lab 2:** Assembly of 8155, Entering Data into RAM |
| 4    | 7 Segments LED Display, Registers and Ports  
**Lab 3:** Assembly of Two 7-Segments LED Displays and Driver Circuits, Testing Registers and Ports |
| 5    | 14-bit Programmable Counter, Continuous Square Wave, Continuous Pulses, Single Square Wave, Single Pulse  
**Lab 4:** Generating Pulses and Waves |
| 6    | Read Only Memory (ROM), Address Lines, I/O Lines, Chip Enable (CE), Output Enable (OE), Write Enable (WE)  
**Lab 5:** Assembly of 2816, Entering Data into ROM |
| 7    | Review and **Midterm Exam** |
| 8    | 8085A Functional Description, Registers, Flags, ALU, 8085A Pin Definition |
| 9    | 8085 Instruction Set, Symbols and Abbreviations, Data Formats, Addressing Modes |
| 10   | Monitor Program, Memory Allocation, Expansion  
**Lab 6:** Assembly of 8085, Initialization of the Monitor Program |
| 11   | Delay Section and Display Section  
**Lab 7:** Implementation of Delay Section and Display Section |
| 12   | Scan, Key Found, and Data Found Sections  
**Lab 8:** Assembly of 25 Dimple Switches, Implementation of Scan, Key Found, and Data Found Sections |
| 13   | Functions: Store (FST), Read (FR), Address High (FAH), Address Low (FAL), Data (FDA), Go (FGO), Reserved (FX1 & FX2)  
**Lab 9:** Implementation of Functions |
| 14   | **Lab 10:** Application Program: Adding Two Single-byte Numbers |
| 15   | **Final Exam** |