COURSE OUTLINE

ELEC 213 - MICROPROCESSORS

Prepared By: Robert Jennings
A. **TITLE:** Microprocessors

B. **COURSE NUMBER:** ELEC 213

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **LENGTH OF COURSE:** 15 Weeks

F. **SEMESTER(S) OFFERED:** Fall and Spring

G. **HOURS OF LECTURE:** 2 hours a week  
   **HOURS OF LABORATORY:** 1 lab/week, 3 hours in length

H. **CATALOGUE DESCRIPTION:**  
The 8085 8-bit instruction set and the internal hardware register are studied. The basic operation of Fetch and Execute operations are examined. The PIC micro family microcontrollers will be introduced to provide the student with hardware and software experience in working with these devices. The student will use a cross-assembler to generate the software programs to be written for the microcontrollers. The RS-232C Serial data transmission interface is also studied.

I. **PRE-REQUISITES/CO-REQUISITES:**  
Pre-requisites: Digital Fundamentals & Systems and Laboratory (ELEC 165/166) or permission of the instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES):**  
By the end of this course, seventy percent of the students will be able to:

<table>
<thead>
<tr>
<th>Course Objectives (STUDENT LEARNING OUTCOMES)</th>
<th>*Institutional SLO</th>
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</table>
| 1. Given a RS-232C voltage wave form, determine the ASCII character being sent. | 2. Crit. Thinking  
3. Prof. Competence |
| 2. Develop a flow chart and a machine language program to copy the contents of one byte of memory to another location in that same memory. | 1. Communications  
2. Crit. Thinking  
3. Prof. Competence |
| 3. Develop a flow chart and an assembly language program to simulate the logical operation between two input signals and display the logical result on an LED connected to an output port. | 1. Communications  
2. Crit. Thinking  
3. Prof. Competence |
| 4. Determine the stack contents after the execution of a main program that contains two nested subroutines. | 2. Crit. Thinking  
3. Prof. Competence |

Intuitional Student Learning Objectives (SLO):  
* (1) Communication, (2) Critical Thinking, (3) Professional Competence,
(4) Inter-Intrapersonal Skills

K. **TEXTBOOK:** Benson, David. (2005) *Easy Microcontrol’n.* 4.1th Ed. Hayden, ID: Square 1 Electronics

L. **REFERENCES:** None

M. **EQUIPMENT:** PIC Microcontroller programmers

N. **GRADING METHOD:** A - F

O. **MEASUREMENT CRITERIA/METHODS:**
   - Hourly exams,
   - Quizzes
   - Homework assignments
   - Written laboratory reports

P. **DETAILED LECTURE OUTLINE:** (See Attached on page 4)

Q. **LABORATORY OUTLINE:** (See Attached on Page 5)
DETAILED LECTURE OUTLINE
ELEC213 - MICROPROCESSORS

I. Introduction to RS-232C Serial Data Transmission Protocol

II. Eight-bit Microprocessor Operation (8085)
   A. Hardware configuration
   B. Fetch and Execute Machine Cycles
   C. Complete operation for MOV IMM Instruction
   D. Stack operations using PUSH and POP Instructions

III. Introduction to Flow Charting

IV. Introduction to the PIC (Peripheral Interface Controller) 8-bit Microcontroller

V. Use of the Cross assembler for the PIC devices

VI. Development of Input/Output programs for the PIC

VII. Development of Logic and Arithmetic operations for the PIC
    A. Logical operations (AND, OR, Ex OR and Complement)
    B. Rotate instructions
    C. Arithmetic Operations (Add and Subtract)

VIII. Development of Decision making operations for the PIC
    A. Branching and Jumps
    B. Use of subtract for Compare operations

IX. Development of Programming for Loops, Counters, Time Delays, and subroutines
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<thead>
<tr>
<th>EXPERIMENT NO.</th>
<th>TITLE</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to the RS 232C Interface</td>
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<tr>
<td>LP-1</td>
<td>Lab Practical for the RS232C Interface</td>
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<tr>
<td>2</td>
<td>Introduction to the PIC Assembler and Flash Programmer</td>
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<tr>
<td>3*</td>
<td>Input/Output Programs for the PIC using Data Directional Registers</td>
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<tr>
<td>4*</td>
<td>Introduction to the PIC Assembler and the Counter Programs</td>
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<td>5*</td>
<td>Introduction to the PIC Assembler and the Delay Programs</td>
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<tr>
<td>6*</td>
<td>Introduction to the PIC Assembler and the Logic Simulator Program</td>
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<tr>
<td>7*</td>
<td>Introduction to the PIC Assembler and the Response Time Program</td>
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<tr>
<td>LP-2</td>
<td>Lab Practical for the PIC</td>
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*Two-week experiment

Revised 5-20-2015