EET 3720 Microprocessor and Programmable Logic Controllers

Course Description: Microprocessors and programmable logics controllers; hardware, assembly language, I/O, interfacing; controls, instrumentation, and communication; furthermore, the application of microcontroller to Programmable Logic Controller will be another focus. The goal of this course is to prepare students to be field engineers with solid microprocessor and programmable controller theoretical knowledge and strong practical ability.

Credit hours: 3 (Lec: 2, Lab: 1)

Time and Location:
Wednesday, 10:30am to 1:30pm, 2018 ETB, 09/1/2010 - 12/05/2010

Instructor: Dr. Wen Chen, 1154 ETB, wchenc@wayne.edu Tel: 313-577-8165

Prerequisites: EET 2720 Microprocessor Fundamentals is required, and MCT 3010 is desired

Texts Required:
• “MC68HC12: An introduction software and hardware interfacing” Han-Way Huang, Thomson Delmar Learning, 2003.
• Allen Bradley MicroLogix On-line Manuals.

Course Contents:
• Introduction of HC12 hardware
• Assembly language
• HC12 parallel I/O, series I/O, analog input
• Introduction of Programmable Logic Controllers (PLC)
• Input devices and output actuators: switches, sensors, transmitters, solenoids, alarms, horns and lights
• Architecture of Allen Bradley MicroLogix: Chassis, Microcontroller module, power supply modules, I/O modules and communication/network modules.
• PLC programming (I): Allen Bradley (AB) memory organization, input/output addressing (Tag based), internal control relay BIT addressing
• PLC programming (II): Input/Output instructions: AB input instructions and output coils
• PLC programming (III): Timers, Counters, parameters and bit addressing: TON, TOF
• PLC programming (IV): Move and Arithmetic instructions: MOVE, ADD, SUD, MUL, DIV, SOR
• PLC programming (V): Comparison Instructions: EQU, NEQ, LES, GRT, LIM
• PLC programming (VI): Program control instructions: JUMP, LBL, MCR, JSR, SBR, RET
• PLC programming (VII): Logic operation instructions: AND, OR, XOR, BSL, BSR
- PLC programming (VIII): Function blocks
- PLC communications/network: PLC network architecture, ControlNet module, and Ethernet
- Design and programming Examples.

**Laboratory:**

1. Assembly programming (1)
2. Assembly programming (2)
3. Ladder-logic diagram programming- fundamentals
4. Ladder-logic diagram programming- Timers and counter
5. Ladder-logic diagram programming- MOVE and arithmetic instructions
6. Ladder-logic diagram programming- Program control and logic operational instructions
7. Function blocks

**Course Learning Objectives:**

Upon successful completion of this the student will be able to:

- Demonstrate configuration and use of M68HC12 microcontroller: hardware, assembly language, I/O, etc. (SO-a,b,E1)
- Identify the basic architecture of PLCs (SO-a)
- Select and apply input and output devices to PLCs (SO-a)
- Demonstrate ability to PLC programming techniques (SO-a,b)
- Implement testing and troubleshooting (SO-a,b)
- Analyze and understand practical requirements for PLC control systems (SO-a)
- Design, select and program various PLC-controller industrial systems (SO-E1,c,d,f)
- Using computer software (Micrologix Starter Lite, Assembly language) to program (SO-b,c)
- Exhibit responsibility in handling of all lab equipment and work effectively as a group in a laboratory environment (SO-e)
- Communicate clearly, concisely and correctly in written, oral and visual forms (as proven in tests and labs), that effectively convey ideas and concepts to peers and faculty, using proper technical terminology (SO-g)

**Assessment:**

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<tr>
<th>Test</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Test 1</td>
<td>15%</td>
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<td>Test 2</td>
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<td>Final exam</td>
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<tr>
<th>Grade</th>
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<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92</td>
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<tr>
<td>B+</td>
<td>87-89</td>
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B  83-86
B-  80-82
C+  77-79
C   73-76
C-  70-72
D+  67-69
D   63-66
D-  60-62
E   Below 60

Contributions to EET Student Outcomes:

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<tr>
<th>BSEET Student Outcomes</th>
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<tr>
<td>3  a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines</td>
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<td>2  b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology</td>
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<td>2  c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes</td>
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<td>3  d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives</td>
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<td>2  e. An ability to function effectively on teams</td>
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<td>2  f. An ability to identify, analyze and solve technical problems</td>
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<td>1  g. An ability to communicate effectively</td>
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<td>1  h. A recognition of the need for, and an ability to engage in lifelong learning</td>
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<td>i.  An ability to understand professional, ethical and social responsibilities</td>
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<td>j.  A respect for diversity and a knowledge of contemporary professional, societal and global issues</td>
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<td>k.  A commitment to quality, timeliness, and continuous improvement</td>
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<td>3  E1 The ability to analyze, design, and implement control systems, instrumentation systems, communication systems, computer systems, or power systems</td>
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<td>E2  The ability to apply project management techniques to electrical/electronic(s)</td>
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The ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems

WITHDRAWAL POLICY:

Last day to drop with a tuition refund: End of 2\textsuperscript{nd} Week of Semester

Last day to drop without a notation of W on the transcript: End of 4\textsuperscript{th} Week

Final day to drop with W (ET Students): End of 8\textsuperscript{th} Week

All drop/add activity during the first four weeks should be done by the student through Pipeline. Withdrawal after the fourth week requires the instructor's permission and must be submitted on a Drop/Add form to the Registrar's Office. Withdrawal after the 'final drop' date will only be permitted under exceptional circumstances and requires the permission of the Chair of the ET Division. A failing grade is not an acceptable reason for withdrawal after the 'final drop' date.

POLICY ON CHEATING:

Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course and may be subject to additional penalties.

University / Department Policies:

Academic Misconduct

http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html

 Withdrawal from Engineering Tech classes

http://www.et.eng.wayne.edu/et/withdrawal/withdrawal.html

Deferred Grades

http://www.et.eng.wayne.edu/et/deferredgrade/deferredgrade.html

Code of Ethics for Engineers:
Students with Disabilities:

"If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University."

Please refer to the SDS website for further information about students with disabilities and the services we provide for faculty and students: http://studentdisability.wayne.edu/

Prepared by: Wen Chen, Ph.D.