



COURSE OUTLINE

ELN335

Prepared: Mark Allemang Approved: Corey Meunier

Course Code: Title	ELN335: EMBEDDED MICROCONTROLLERS I
Program Number: Name	4029: ELECTRICAL TY-PROCES
Department:	ELECT./INSTRUMENTATION PS
Semester/Term:	17F
Course Description:	Students will study the architecture and programming of embedded microcontrollers in computer interfacing applications. Lab activities involving computer interfacing to hardware and the associated software requirements will support the theory.
Total Credits:	3
Hours/Week:	3
Total Hours:	45
Prerequisites:	ELN115
This course is a pre-requisite for:	ELN340
Essential Employability Skills (EES):	<p>#1. Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</p> <p>#3. Execute mathematical operations accurately.</p> <p>#4. Apply a systematic approach to solve problems.</p> <p>#5. Use a variety of thinking skills to anticipate and solve problems.</p> <p>#6. Locate, select, organize, and document information using appropriate technology and information systems.</p> <p>#7. Analyze, evaluate, and apply relevant information from a variety of sources.</p>
Course Evaluation:	Passing Grade: 50%, D
Other Course Evaluation & Assessment Requirements:	<p>It is required to achieve a passing grade (50%) in both the theory and the lab part of this course. For example, it is not possible to pass the course if a student has a failing average in the three written tests but is passing the lab portion, (or vice versa). Written tests constitute the theory portion of the mark.</p> <p>Grade Definition Grade Point Equivalent</p>



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- A+ 90 – 100% 4.00
- A 80 – 89%
- B 70 - 79% 3.00
- C 60 - 69% 2.00
- D 50 – 59% 1.00
- F (Fail) 49% and below 0.00

- CR (Credit) Credit for diploma requirements has been awarded.
- S Satisfactory achievement in field /clinical placement or non-graded subject area.
- U Unsatisfactory achievement in field/clinical placement or non-graded subject area.
- X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
- NR Grade not reported to Registrar’s office.
- W Student has withdrawn from the course without academic penalty.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments	35%
Tests	65%

Books and Required Resources:

The Technicians guide to the 68HC11 Microcontroller by Daniel J. Black
 Publisher: Delmar
 ISBN: 07668-1715-6

Course Outcomes and Learning Objectives:

Course Outcome 1.

Describe the architecture of the 68HC11 microcontroller including its registers, memory organization, the stack and internal organization.

Learning Objectives 1.

- Sketch the Software model of the 68HC11 Microcontroller.
- List and explain the nature and functioning of the 68HC11 internal registers.
- Explain the nature of memory and memory variables including addresses and data.
- Utilize the stack as a temporary storage mechanism

Course Outcome 2.



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Demonstrate the use of the assembler and simulator to assemble, load, save, unassemble, single step, examine and troubleshoot simple instruction sequences.

Learning Objectives 2.

Compare and contrast machine code and assembly language
Explain and demonstrate the method of converting assembly language instructions to machine language.

Demonstrate the use the simulator to:

Examine and modify the contents of memory and registers

Assemble and Unassemble machine instructions

Execute and single-step through programs and other tasks required in program debugging.

Course Outcome 3.

Write assembly language programs utilizing the subset of commonly used 68HC11 instructions and memory addressing modes to solve simple problems.

Learning Objectives 3.

The student will write code which demonstrates the operation of the following groups of instructions:

- a) Data transfer instructions
- b) Arithmetic instructions
- c) Logic instructions
- d) Shift and rotate instructions
- e) Flag-control instructions
- f) Compare instructions
- g) Branch instructions
- h) Subroutine handling

Students will write programs to solve assigned problems using the instructions and addressing modes most appropriate to the task.

Course Outcome 4.



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Write simple programs which utilize the various ports in order to interface to digital hardware.

Learning Objectives 4.

Explain the input/output system of a 68HC11 including basic parallel input/output, analog to digital and if time permits the Timer subsystem

Write programs to control LED's on the 68HC11 development systems or equivalent simulator

Write programs to read in and test the status of switches (DIP or otherwise) on the 68HC11 development systems or equivalent simulator.

Write programs to sense the position of a potentiometer

Course Outcome 5.

Utilize Interrupts as a way to sense an external event.

Learning Objectives 5.

Use the IRQ interrupt to cause an event to occur while the microcontroller is running another program.

Write initialization and servicing code to process an interrupt

Differentiate between EDGE Triggered and Level triggered interrupts.

Course Outcome 6.

Use the onboard debug monitor program of the microcontroller.

Learning Objectives 6.

Use the BUFFALO monitor to perform various functions in the program development/debug phase.

Date:

Friday, September 1, 2017

Please refer to the course outline addendum on the Learning Management System for further information.



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