SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	EMBEDDED MICROCONTROLLERS I		
CODE NO. :	ELN335	**SEMESTER:**	5
PROGRAM:	ELECTRICAL ENGINEERING TECHNOLOGY – PROCESS AUTOMATION		
AUTHOR:	MARK ALLEMANG		
DATE:	September 2011	**PREVIOUS OUTLINE DATED:**	September 2010
APPROVED:	*"Corey Meunier"*		
	CHAIR		**DATE**
TOTAL CREDITS:	4		
PREREQUISITE(S):	ELN115 – Digital Integrated Electronics		
HOURS/WEEK:	4		

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I. COURSE DESCRIPTION

This course introduces students to Assembly Language Programming for the Motorola MC68HC11 Microcontroller. As a first course in assembly language programming it is necessary to study the fundamentals of microprocessor architecture in addition to the specific registers, addressing modes and instructions of the microcontroller. Initially the concentration is on the development of simple instruction sequences using a PC based assembler and microcontroller simulator. Later, the students will download and test their programs on a functioning 68HC11 microcontroller board

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

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

Potential Elements of the Performance:

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

This learning outcome will constitute approximately 15% of the course. Reference: Text Chapt. 1,6.

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

Potential Elements of the Performance:

- Compare and contrast machine code and assembly language
- Describe 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.

This learning outcome will constitute approximately 20% of the course. Reference: Text Appendix A.

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

Potential Elements of the Performance

The student will demonstrate the operation of the following groups of instructions and their proper utilization in programs:

		Text Reference
a)	Data transfer instructions	3.2,
b)	Arithmetic instructions	3.3, 3.4
c)	Logic instructions	3.5
d)	Shift and rotate instructions	3.6
e)	Flag-control instructions	3.8
f)	Compare instructions	4.4
g)	Branch instructions	4.1,4.2
h)	Subroutine handling	6.

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

This learning outcome will constitute approximately 30% of the course.

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

Potential Elements of the Performance:

- 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.

This learning outcome will constitute approximately 20% of the course. Reference: Chapt. 9.

5. Describe the use of Interrupts as a way to sense an external event.

Potential Elements of the Performance:

- Use the IRQ interrupt to cause an event to occur while the microcontroller is running another program.
- Differentiate between EDGE Triggered and Level triggered interrupts.

This learning outcome will constitute approximately 5% of the course. Reference: Chapt. 10.

6. Use the onboard debug monitor program of the microcontroller.
Potential Elements of the Performance:

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

This learning outcome will constitute approximately 10% of the course. Reference: Chapt. 1.

III. TOPICS:

1. 68HC11 Organization and Registers.
2. 68HC11 Addressing Modes.
3. The use of the assembler and simulator to assemble and troubleshoot simple programs.
4. Instruction Set of the 68HC11 Microcontroller.
5. Input/output programming.
6. Interrupts
7. Buffalo Monitor

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

TEXT BOOK:

"The Technicians guide to the 68HC11 Microcontroller"
by Daniel J. Black., Delmar Publishing ISBN 07668-1715-6

V. EVALUATION PROCESS/GRADING SYSTEM:

3 WRITTEN TESTS	60%
LAB PROJECTS/ASSIGNMENTS	30%
QUIZZES	5%
LAB ATTENDANCE	5%

(The percentages shown above may vary slightly if circumstances warrant.)

NOTE: 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).

The following semester grades will be assigned to students:

Grade	Definition	*Grade Point Equivalent*
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.

UPGRADING OF INCOMPLETES

When a student's course work is incomplete or final grade is below 50%, there is the possibility of upgrading to a pass when a student meets all of the following criteria:

1. The student’s attendance has been satisfactory.
2. An overall average of at least 45% has been achieved.
3. The student has not had a failing grade in all of the theory tests taken.
4. The student has made reasonable efforts to participate in class and complete assignments.

The nature of the upgrading requirements will be determined by the instructor and may involve one or more of the following: completion of existing labs and assignments, completion of additional assignments, re-testing on individual parts of the course or a comprehensive test on the entire course.

LABS:

Lab activities represent a very important component of this course. Because of this, attendance is mandatory and the satisfactory completion of all lab activities is required. It is the student's responsibility to discuss absences from regularly scheduled labs with the instructor so that alternate arrangements (where possible) can be made to complete the lab requirements.

It is acceptable that students consult with each other in relation to their assigned problems. However, it is unacceptable to copy programs written by someone else and submit them as your own work. Where plagiarism or copying is found and it is impossible to determine whose original work it is, a mark of zero will be assigned to all assignments involved.

VI. SPECIAL NOTES:

Attendance:
Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.