Processor Architecture

Information and Communications Technology

Course Number:	Co-Requisites:	Pre-Requisites:
CST8216	N/A	CST8101
Applicable Program(s):	**AAL:**	**Core/Elective:**
0006X01FWO - Computer Eng. Technology - Comp. Science	3	Core
0006X03FWO - Computer Eng. Technology - Comp. Science	3	Core
Prepared by:	D. Haley, Professor	
Approved by:	Andrew Pridham, Academic Chair, ICT	
Approval Date:	Wednesday, June 24, 2015	
Approved for Academic Year:	2015-2016	
Normative Hours:	75.00	

Course Description

Students learn how logic circuits are used in typical microprocessors. Elementary electronic components, basic numerical systems and operations, Boolean logic and logic gates are explored with their relationship to a microprocessor/microcomputer. Students also learn microcontroller programming using assembly language. The theory is supported by lab exercises involving the creation and analysis of logic circuits using simulation software and the programming of a microcontroller.

Relationship to Vocational Learning Outcomes

This course contributes to your program by helping you achieve the following Vocational Learning Outcomes:

0006X01FWO - Computer Eng. Technology - Comp. Science

VLO 1	Diagnose, solve, troubleshoot, and document technical problems involving computing devices using appropriate methodologies. (T,A)
VLO 3	Participate in analyzing, planning, designing, and developing the architecture of computing devices and systems. (T,A)
VLO 4	Plan, install, configure, modify, test, and maintain a variety of computer systems to meet functional requirements. (T,A)
VLO 5	Apply principles of digital and analog circuits to the implementation of embedded computing devices. (T,A)
VLO 6	Analyze, build, test, implement, and maintain applications. (T,A)
VLO 8	Articulate, defend, and conform to workplace expectations found in technology environments. (T,A)

0006X03FWO - Computer Eng. Technology - Comp. Science

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Relationship to Essential Employability Skills

This course contributes to your program by helping you achieve the following Essential Employability Skills:

EES 3	Execute mathematical operations accurately. (T,A)
EES 4	Apply a systematic approach to solve problems. (T,A)
EES 5	Use a variety of thinking skills to anticipate and solve problems. (T,A)
EES 10	Manage the use of time and other resources to complete projects. (T,A)
EES 11	Take responsibility for one's own actions, decisions and consequences. (T,A)

Course Learning Requirements/Embedded Knowledge and Skills

When you have earned credit for this course, you will have demonstrated the ability to:

1.) Apply knowledge of analog circuit design to the implementation of embedded computing devices

Define the following terms: Voltage, Current, Resistance and Power

Characterize the operation of the following devices: Light Emitting Diodes (LEDs), Hex Displays, Resistors, and Switches.

Predict voltage, current, and power values for simple circuits containing combinations of the following devices: Voltage Source, Resistors, a Fuses and Switches.

2.) Analyze circuit diagrams involving embedded computing devices.

Describe the functionality of a simple Central Processing Unit (CPU)'s components:

a. Arithmetic Logic Unit (ALU)
b. Registers
c. Memory, Input/Output (I/O) Interface
d. Control Unit
e. Clock
f. BUS

3.) Explore arithmetic principles as they relate to the implementation of embedded computing devices.

Calculate the results of arithmetic and logical operations on signed and unsigned integer binary and integer hexadecimal numbers.

Determine when overflow conditions exist and describe the relationship to processor architecture.

Construct numbers in the following numbering systems:

a. Hexadecimal and Binary Coded Decimal
b. Binary Coded Decimal (BCD)

4.) Apply knowledge of digital circuit design to the implementation of embedded computing devices.

Characterize the operation of Logic Functions and Gates in simple combinational logic circuits

Characterize the operation of logic gates when used to enable/disable digital circuitry.

5.) Use simulation to test configurations and interfaces prior to implementation.

Analyze, design, construct, and troubleshoot simple analog circuits using MultiSim.

Write simple programs in assembly language to be analyzed, debugged, and verified using simulation techniques.

Identify 68HC12 Classes of Instructions, explain their use, and apply them in assembly language programs:

a. Load, Store, Move, and Transfer
b. Arithmetic
c. Compare and Test
d. Boolean Logic and Bit Oriented
e. Shift and Rotate
f. Branch and Jump

Identify 68HC12 Addressing Modes, explain their use, and apply them in assembly language programs:

a. Inherent
b. Immediate
c. Direct and Extended
d. Relative
e. Constant Offset Indexed
f. Constant Indirect
g. Auto Pre/Post Decrement/Increment Indexed
h. Accumulator Offset Indexed

Create Flow Charts, Algorithms and Pseudocode to represent a problem-solution.

Predict the results of program execution with the use of a Test Plan.

Document program development using tools such as Microsoft Visio and Microsoft Word or their Open Source equivalents.

6.) Apply knowledge of programming languages as it relates to embedded computing devices.

Write simple programs in HCS12 assembly language to be deployed on the Dragon12-Plus(tm) Freescale HCS12 / 9S12 microcontroller trainer and simulators.

7.) Apply time management skills in the preparation and completion of course work and take appropriate action to correct academic shortcomings.

Complete pre-lab, lab and post-lab work so that course lab assignments are completed according to schedule.

Attend lectures and complete hybrid lectures/exercises so that they are completed according to schedule.

Prepare for all course assessments.

8.) Apply knowledge of lab safety when working with solid state electronic devices.

Practise lab safety with respect to electronic devices that are sensitive to damage caused by Electrostatic Discharge (ESD).

Learning Resources

Required

This course is part of the Bring Your Own Device (BYOD) program initiative at Algonquin College. Students are required to have a functioning laptop (running Windows 7 or 8) at all lecture and lab classes. The specifications for the required laptop and additional information about the mobile program initiative can be found at: http://www.algonquincollege.com/onlineresources

Required Textbooks and Software:

Each registered student will be provided with the following:

- A licensed copy of the 68HC(S)12 Simulator and CD Textbook by Tom Almy
- A copy of ASMIDE and the GNU Development Chain for the Motorola 68HC11 and 68HC12 microcontrollers will also be supplied
- A licensed copy of Multisim by National Instruments

Required Tools and Supplies:

- Pair of Audio Headsets to listen to the audio portion of Hybrid course material
- USB Drive to transport lab/assignment code
- Calculator – must be capable of solving exponential equations, exponents, Engineering and Scientific notations

Other Relevant Resources:

- Blackboard Website: http://online.algonquincollege.com/
- Various course handouts and texts (on loan) provided by the course professor

Learning Activities

- Classroom lectures
- Software demonstrations
- Hybrid activities - lectures, handouts, quizzes, pre-lab work, post-lab work, readings, tutorials
- Individual lab assignments (smaller tasks)
- Grouped lab assignments (larger tasks)
- Homework
- Reading assignments

Course Delivery:

- This course consists of 2 hours of lecture in classroom and 2 hours of lab work per week, as well as 1 hour per week of hybrid activities.
- To be successful in this course, you should expect to spend 5 hours of homework per week, on average.
- The course Professor will inform students at the beginning of the course of suitable times for consultation.
- Students are encouraged to ask questions during lectures, lab sessions, and hybrid activities and to consult with the course Professor on topics that they do not clearly understand. The course material is cumulative and does not lend itself well to "cramming" at the last minute. Ask your questions early and often.

Lectures:

- Students are expected to attend all of the lectures and take notes.
- Since this course is part of a BYOD program of study, students are expected to bring their laptops to lectures and to use them in the educational manner as directed by the course Professor
- Theoretical course material will be presented, aided by use of overhead projections, demonstrations and other lecture material during lectures. Students are responsible for all the theoretical material presented. If students miss a lecture, they should make sure they get the relevant notes from another student as soon as possible after the class you missed.
- Students are expected to read and understand specific sections of the textbook. Some of this material may not be directly covered in class lectures; rather, it could be in the form of a lab assignment or hybrid reading

assignment. Students will be expected to ask for clarification and explanations of the material, as required.

Lab Periods:
- Students are expected to attend all of the labs.
- Students are expected to perform initial analysis and design before their scheduled lab in order to take advantage of the limited lab time.
- Since this course is part of a BYOD program of study, students are expected to install all course-required software on their laptops and to bring their laptops to the lab and to use them in the educational manner directed by the course Professor.
- Students must ensure that any code produced for the Dragon12-Plus hardware has been first thoroughly tested using simulation tools wherever possible. Failure to do so may result in not being able to complete lab assignments during the allocated lab period since the number of Dragon12-Plus hardware boards is limited and they are only available to students during the course allocated lab periods.
- Students are expected to work after hours on lab assignments that they have not completed during normal lab time.
- Problem-solving lab assignments will be used to reinforce and expand upon theoretical course material. New theoretical material may be presented during lab sessions.
- Students are expected to work in the lab and to attempt to solve problems encountered on their own or with assistance from other students. When a difficult problem arises, the course Professor will try to assist the student in finding resources and developing strategies for solving the problem.
- Students are expected to complete all required assignments in a satisfactory manner and to demonstrate their competence in the lab as requested.
- Students' ability to successfully understand and complete individual and group lab assignments will directly correlate with their level of success on quizzes, tests and the final exam.
- Students should seek advice and help from the course Professor in the lab.

Hybrid:
- This form of course delivery will constitute approximately 33% of the delivery of course material.
- Blackboard, hand outs at lectures and/or Internet-based resource sites will be used to present the hybrid course material.
- Online hybrid course material may consist of multi-media presentations, readings, and quizzes. In the case of multi-media presentations, students must supply their own headsets to listen to the audio component of material.
- Students' ability to successfully complete hybrid course material will directly correlate with their level of success on hybrid quizzes, classroom tests and the final exam.

Working in Groups :
- Larger lab assignments will usually be conducted in groups, while smaller ones will be completed individually.
- The process used for the grouping of students will be defined by the course Professor.
- All members of a group must be present during demos and other forms of evaluation. An absent member may not receive full credit for that particular lab assignment.

Evaluation/Earning Credit

The following list provides evidence of this course's learning achievements and the outcomes they validate:

Lab Activity(ies) (40%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 5, CLR 6, CLR 7, CLR 8, EES 3, EES 4, EES 5, EES 10, EES 11

Hybrid Assignment(s) (10%)

Validates Outcomes: CLR 2, CLR 3, CLR 4, CLR 5, CLR 6, CLR 7, CLR 8, EES 4, EES 5, EES 10, EES 11

Midterm Exam(s) (20%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 6, CLR 7, EES 3, EES 4, EES 5, EES 10, EES 11

Final Exam (30%)

Validates Outcomes: CLR 1, CLR 2, CLR 3, CLR 4, CLR 6, EES 3, EES 4, EES 5, EES 10, EES 11

Prior Learning Assessment and Recognition

Students who wish to apply for prior learning assessment and recognition (PLAR) need to demonstrate competency at a post-secondary level in all of the course learning requirements outlined above. Evidence of learning achievement for PLAR candidates includes:

- Challenge Exam
- Project/Assignment

Grade Scheme

Final Grade	Mark Equivalent	Numeric Value	Final Grade	Mark Equivalent	Numeric Value
A+	90% - 100%	4.0	A	85% - 89%	3.8
A-	80% - 84%	3.6	B+	77% - 79%	3.3
B	73% - 76%	3.0	B-	70% - 72%	2.7
C+	67% - 69%	2.3	C	63% - 66%	2.0
C-	60% - 62%	1.7	D+	57% - 59%	1.4
D	53% - 56%	1.2	D-	50% - 52%	1.0
F	0% - 49%	0	FSP	0	0

Course Related Information

In order to pass this course, the student must have a grade of at least at least 50% or 'D- on Lab Assignments/Hybrid activities (25/50) and at least 50% or 'D-' on Term Tests/Final Exam (25/50).

- Test dates will be announced by the course Professor as well as recorded in the Course Section Information (CSI) document.
- Final Exam date will be during Final Assessment week as scheduled on Student ACSIS.
- The ICT Department requires that all course assignments (homework exercises, laboratory work, projects, etc.) be submitted by students using a standard that could be specific to one or more courses. Course Professors will ensure, at the beginning of the term, that students are advised of the exact details of these course specific submission requirements.
- Student submissions that do not meet the course published submission standards may not be marked, and may incur a penalty of up to 100% of the submission mark.
- Late Hybrid submissions or lab assignment demonstrations/submissions will receive a mark of zero. Partially completed work may be eligible for significant partial marks and should be presented for evaluation in spite of its unfinished state.
- All students are required to write the final exam. There are no provisions for "making up" a missed final exam. If,

as a result of being off-track in your program or some unforeseen circumstance, you note that there is a scheduling conflict in your final exam schedule, it is your responsibility to alert your course Professor no later than one week before final exams start, to allow for any special arrangements.

Department Related Information

STUDENT ACADEMIC RESPONSIBILITIES

Each student is responsible for:
• Knowing the due dates for marked out-of-class assignments.
• Attending all classes and knowing the dates of in-class marked assignments and exercises.
• Maintaining a folder of all work done in the course during the semester for validation claims in cases of disagreement with faculty.
• Keeping both paper and electronic copies of all assignments, marked and unmarked, in case papers are lost or go missing.
• Regularly checking both Blackboard announcements as well as one's Algonquin e-mail account for important messages from both professors and college administration.
• Participating in on-line and classroom exercises and activities as required.
• Retaining course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether involving a professor and a student or amongst students, will not be tolerated on the college premises. Action taken will start with a formal warning and proceed to the full disciplinary actions as outlined in Algonquin College Policies - HR22 and SA07.
Harassment means one or a series of vexatious comment(s) (whether done verbally or through electronic means), or conduct related to one or more of the prohibited grounds that is known or ought reasonably to be known to be unwelcome/unwanted, offensive, intimidating, derogatory or hostile. This may include, but is not limited to: gestures, remarks, jokes, taunting, innuendo, display of offensive materials, offensive graffiti, threats, verbal or physical assault, stalking, slurs, shunning or exclusion related to the prohibited grounds.

For further information, a copy of the official policy statement can be obtained from the Student Association.

Violation of the Copyright Act
General – The Copyright Act makes it an offence to reproduce or distribute, in whatever format, any part of a publication without the prior written permission of the publisher. For complete details, see the Government of Canada website at http://laws.justice.gc.ca/en/C-42 . Make sure you give it due consideration, before deciding not to purchase a textbook or material required for your course.

Software Piracy - The Copyright Act has been updated to include software products. Be sure to carefully read the licensing agreement of any product you purchase or download, and understand the terms and conditions covering its use, installation and distribution (where applicable). Any infringement of licensing agreement makes you liable under the law.

Disruptive Behaviour is any conduct, or threatened conduct, that is disruptive to the learning process or that interferes with the well being of other members of the College community. It will not be tolerated. Members of the College community, both students and staff, have the right to learn and work in a secure and productive environment. The College will make every effort to protect that right. Incidents of disruptive behaviour must be reported in writing to the departmental Chair as quickly as possible. The Chair will hold a hearing to review available information and determine any sanctions that will be imposed. Disciplinary hearings can result in

penalties ranging from a written warning to expulsion.

For further details, consult the Algonquin College Policies AA32, SA07 and IT01 in your Instaguide.

College Related Information

Email

Algonquin College provides all full-time students with an e-mail account. This is the address that will be used when the College, your professors, or your fellow students communicate important information about your program or course events. It is your responsibility to ensure that you know how to send and receive e-mail using your Algonquin account and to check it regularly.

Students with Disabilities

If you are a student with a disability, it is strongly recommended that you identify your needs to your professor and the Centre for Students with Disabilities (CSD) or Student Services, by the end of the first month of the semester in order that necessary accommodations or support services can be arranged for you.

Academic Integrity & Plagiarism

Adherence to acceptable standards of academic honesty is an important aspect of the learning process at Algonquin College. Academic work submitted by a student is evaluated on the assumption that the work presented by the student is his or her own, unless designated otherwise. For further details consult Algonquin College Policies AA18: Academic Dishonesty and Discipline and AA20: Plagiarism

Student Course Feedback

It is Algonquin College's policy to give students the opportunity share their course experience by completing a student course feedback survey for each course they take. For further details consult Algonquin College Policy AA25: Student Course Feedback

Use of Electronic Devices in Class

With the proliferation of small, personal electronic devices used for communications and data storage, Algonquin College believes there is a need to address their use during classes and examinations. During classes, the use of such devices is disruptive and disrespectful to others. During examinations, the use of such devices may facilitate cheating. For further details consult Algonquin College Policy AA32: Use of Electronic Devices in Class

Transfer of Credit

It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Note: *It is the student's responsibility to refer to the Algonquin College Policies website for the most current information at http://www.algonquincollege.com/directives/*

Legend

Terms

- ALO: Aboriginal Learning Outcome
- Apprenticeship LO: Apprenticeship Learning Outcome
- CLR: Course Learning Requirement
- DPLO: Degree Program Learning Outcome
- EES: Essential Employability Skill
- EOP: Element of Performance
- GELO: General Education Learning Outcome

•LO: Learning Outcome
•PC: Program Competency
•PLA: Prior Learning Assessment
•PLAR: Prior Learning Assessment and Recognition
•VLO: Vocational Learning Outcome

Assessment Levels

•T: Taught
•A: Assessed
•CP: Culminating Performance