

Circuit Applications

Mechanical and Transportation Technology

Course Number: ELN9192	Contribution to Program: Vocational	Normative Hours: 90
Applicable Program(s): 0550X01FWO EME Technician - Robotics	AAL: 2	Core/Elective: Core
Prepared by: Steven Walford Professor		Approval Date: 24/06/2012
Co-Requisites N/A		Approved by: Misheck Mwaba, Ph.D., P.Eng. Chair, Mechanical & Transportation Technology
Pre-Requisites ELN9103		Approved for Academic Year: 2012-2013

COURSE DESCRIPTION

This is an intense theory and lab course offered in an independent learning mode. The properties and uses of semi-conductors are related to solid-state devices, diodes, transistors and integrated circuits. Lab experiments examine and illustrate the proper use of semi-conductor components. Components are then tied together to form amplifiers, operational amplifiers and power supplies. The course is built on a series of modules, where each module is a building block for the next. Analytical skills and troubleshooting skills are further developed through the use of experiments. The theory and experience used have widespread applications in electronics.

RELATIONSHIP TO VOCATIONAL LEARNING OUTCOMES

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

EME Technician - Robotics 0550X01FWO

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| 2 | Interpret and produce electrical, electronic, and mechanical drawings and other related documents and graphics to appropriate engineering standards.(T) |
| 3 | Select and use a variety of troubleshooting techniques and test equipment to assess electromechanical circuits, equipment, processes, systems, and subsystems.(T,A,CP) |
| 4 | Modify, maintain, and repair electrical, electronic, and mechanical components, equipment, and systems to ensure that they function according to specifications.(T,A,CP) |
| 5 | Apply the principles of engineering, mathematics, and science to analyze and solve routine technical problems and to complete work related to electromechanical engineering.(T) |
| 6 | Assist in the specification of manufacturing materials, processes, and operations to support the design and production of mechanical components.(T) |
| 7 | Analyze, build, and troubleshoot logic and digital circuits, passive AC and DC circuits, and active circuits.(T,A,CP) |
| 8 | Apply, install, test, and troubleshoot a variety of mechanical, electrical, and electronic control systems.(T) |
| 9 | Install and troubleshoot basic computer hardware and programming to support the electromechanical engineering environment.(T,A) |
| 14 | Perform all work in accordance with relevant law, policies, codes, regulations, safety procedures, and standard shop practices.(T,A,CP) |
| 15 | Develop personal and professional strategies and plans to improve job performance and work relationships with clients, coworkers, and supervisors.(T,A) |

T: Teach **A:** Assess **CP:** Culminating Performance

ESSENTIAL EMPLOYABILITY SKILLS

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

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|---|--|
| 1 | Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience.(T,A,CP) |
| 3 | Execute mathematical operations accurately.(T,A,CP) |
| 4 | Apply a systematic approach to solve problems.(A) |

5	Use a variety of thinking skills to anticipate and solve problems.(A)
6	Locate, select, organize and document information using appropriate technology and information systems.(T,A)
7	Analyze, evaluate and apply relevant information from a variety of sources.(T,A)
8	Show respect for diverse opinions, values, belief systems and contributions of others. (T)
11	Take responsibility for one's own actions, decisions and consequences.(T,A,CP)

T: Teach **A:** Assess **CP:** Culminating Performance

COURSE LEARNING REQUIREMENTS/EMBEDDED KNOWLEDGE AND SKILLS

COURSE LEARNING REQUIREMENTS When you have earned credit for this course, you will have demonstrated the ability to:	EMBEDDED KNOWLEDGE AND SKILLS
1. Construct circuits using diodes and transistors and explain their various applications	<ul style="list-style-type: none"> 1 Demonstrate the diode in terms of its characteristics and its uses as a rectifier and in power supplies 1 Explain the different types of Special Purpose diodes 1 Demonstrate the DC operation of a Bipolar Junctions Transistor (BJT) 1 Identify Class A and Class B Amplifiers 1 Demonstrate the use of a BJT as a switch 1 Explain the DC operation of a Field Effect Transistor (FET) 1 Demonstrate the use of a FET as an amplifier and as a feedback oscillator
2. Construct circuits using the operational amplifier and explain the basic uses of the op-amp.	<ul style="list-style-type: none"> 1 Explain the Differential Amplifier, Op-Amp Parameters and Negative Feedback 1 Describe the various Op-Amp Configurations with Negative Feedback and explain what is meant by Op-Amp impedances 1 Explain and demonstrate Comparators, Summing Amplifiers, Integrators and Differentiators, Oscillators, Active Filters and Voltage Regulators as they relate to the Op-Amp
3. Explain the different types of special purpose op-amp circuits and the various methods used for measurement, conversion and control	<ul style="list-style-type: none"> 1 Explain instrumentation, isolation and operational transconductance amplifiers 1 Explain active diode circuits 1 Demonstrate current sources and converters 1 Explain various types of measurement circuits including: temperature, strain, pressure, flow rate and motion 1 Explain different types of circuits including: Sample and Hold, Analog to Digital and Power-Control
4. Demonstrate and Explain the Basic Uses of Labview	<ul style="list-style-type: none"> 1 Explain the term VI, Identify and explain the Front Panel, the Block Diagram and the various controls on the Control and Functions Palettes as well as Express VIs 1 Demonstrate how to customize an existing VI and how to create one from scratch. Demonstrate use of the loop and the Error List Window, how to control the speed of execution and how to use a table to display data. Demonstrate how to use the Help Window. 1 Demonstrate how to build an Analysis Virtual Instrument by adding one and two signals, filtering a signal, and how to add warning lights during compare instructions. Demonstrate how to save data to a file and how to pick specific values to save to a file and finally how to retrieve that information.

LEARNING RESOURCES

Electronics Fundamentals: Circuits, Devices and Applications 8th Edition (Required)

ISBN: 0135072956

Author: Floyd Publisher: Pearson

Lab Manual for Electronics Fundamentals 8th Edition (Required)

ISBN: 0135063272

Author: Buchla Publisher: Pearson

Getting Started with Labview Tutorial available in Labview

Documents as posted on Blackboard.

LEARNING ACTIVITIES

During this course, you are likely to experience the following learning activities:

Lectures are used to bring forth practical data gathering and outputting to the appropriate device. A large portion of this course is achieved by hands on practical experience. Some peer teaching and collaborated learning may be involved. A complete list of required labs is available on blackboard.

EVALUATION/EARNING CREDIT

The following will provide evidence of your learning achievements:	This activity validates the following Course Learning Requirements and/or Essential Employability Skills:
<p>Chapter Tests 70%</p> <p>Tests include theory and practical with the following weights:</p> <p>CLR1 - 20%</p> <p>CLR2 - 20%</p> <p>CLR3 - 20%</p> <p>CLR4 - 10%</p>	<ul style="list-style-type: none"> 1 Construct circuits using the operational amplifier and explain the basic uses of the op-amp. - [CLR 2] 1 Explain the different types of special purpose op-amp circuits and the various methods used for measurement, conversion and control - [CLR 3] 1 Demonstrate and Explain the Basic Uses of Labview - [CLR 4] 1 Construct circuits using diodes and transistors and explain their various applications - [CLR 1] 1 Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience. - [EES 1] 1 Execute mathematical operations accurately. - [EES 3] 1 Apply a systematic approach to solve problems. - [EES 4] 1 Use a variety of thinking skills to anticipate and solve problems. - [EES 5] 1 Take responsibility for one's own actions, decisions and consequences. - [EES 11]
<p>Labs 26%</p> <p>8% for Sign Off Sheets (4 CLR Sign Off Sheets at 2% each)</p> <p>18% for lab experiments (18 labs at 1% each)</p>	<ul style="list-style-type: none"> 1 Construct circuits using the operational amplifier and explain the basic uses of the op-amp. - [CLR 2] 1 Explain the different types of special purpose op-amp circuits and the various methods used for measurement, conversion and control - [CLR 3] 1 Demonstrate and Explain the Basic Uses of Labview - [CLR 4] 1 Construct circuits using diodes and transistors and explain their various applications - [CLR 1] 1 Communicate clearly, concisely and correctly in the written, spoken and visual form that fulfills the purpose and meets the needs of the audience. - [EES 1] 1 Execute mathematical operations accurately. - [EES 3] 1 Apply a systematic approach to solve problems. - [EES 4] 1 Use a variety of thinking skills to anticipate and solve problems. - [EES 5]

	<ul style="list-style-type: none"> 1 Locate, select, organize and document information using appropriate technology and information systems. - [EES 6] 1 Analyze, evaluate and apply relevant information from a variety of sources. - [EES 7] 1 Show respect for diverse opinions, values, belief systems and contributions of others. - [EES 8] 1 Take responsibility for one's own actions, decisions and consequences. - [EES 11]
<p>Quizzes 4%</p> <p>1 Quiz for each CLR (4 Quizzes at 1% each)</p>	<ul style="list-style-type: none"> 1 Construct circuits using the operational amplifier and explain the basic uses of the op-amp. - [CLR 2] 1 Explain the different types of special purpose op-amp circuits and the various methods used for measurement, conversion and control - [CLR 3] 1 Demonstrate and Explain the Basic Uses of Labview - [CLR 4] 1 Construct circuits using diodes and transistors and explain their various applications - [CLR 1] 1 Execute mathematical operations accurately. - [EES 3] 1 Apply a systematic approach to solve problems. - [EES 4] 1 Use a variety of thinking skills to anticipate and solve problems. - [EES 5] 1 Locate, select, organize and document information using appropriate technology and information systems. - [EES 6] 1 Analyze, evaluate and apply relevant information from a variety of sources. - [EES 7] 1 Take responsibility for one's own actions, decisions and consequences. - [EES 11]

COLLEGE GRADING NUMERICAL EQUIVALENT TABLE

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

OTHER COURSE INFORMATION

Students are required to respect the confidentiality of employer, client and/or patient information, interactions, and practices that occur either on Algonquin College premises, or at an affiliated clinical/field/co-op placement site. Concerns regarding clients, patients, and/or employer practices are to be brought to the attention of the program coordinator, or designated field/clinical/co-op placement supervisor so that they may be resolved collaboratively. Such concerns are not to be raised publically either verbally, in writing, or in electronic forums. These matters are to be addressed through established program communication pathways.

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:

- 1 Portfolio
- 1 Challenge Exam

- 1 Performance Test
- 1 Project/Assignment

RELATED INFORMATION

The following information is course-specific:

Required Equipment:

Safety Glasses

Closed-toed shoes

Electronics toolkit consisting of cutters, wire strippers, needlenose pliers, protoboard, small electronic screwdriver kit, 2 oscilloscope leads, 2 BNC to alligator leads and 3 sets of metre leads.

Refer to your CSI under Course Information on Blackboard for the updated Lab and Testing Policy.

The following information is school/department-specific:

GENERAL CLAUSES - School of Advanced Technology

Harassment/Discrimination/Violence will not be tolerated. Any form of harassment (sexual, racial, gender or disability-related), discrimination (direct or indirect), or violence, whether towards a professor 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 Policy - HR22.

Harassment means one or a series of vexatious comment(s) 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, academic penalties, 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.

The Use of Electronic Devices, with the sound turned on, during classes is strictly prohibited. In particular, cell phones are not to be used to communicate during a class. The use of any electronic devices during exams and mid-term tests, other than those sanctioned by the faculty in charge of the examination, is strictly prohibited.

Anyone caught using a prohibited device will be considered to have plagiarized, and will be treated as such in accordance with College Plagiarism Policy. For further details on this directive, consult the Algonquin College Policy AA32 on the use of Electronic Devices in Class and Exams.

The School of Advanced Technology's Standard Operating Procedure on Plagiarism and Academic Honesty defines plagiarism as an attempt to use or pass off as one's own idea or product, work of another without giving credit. Plagiarism has occurred in instances where a student either directly copies another person's work without acknowledgement; or, closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or, borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as one's own thought, where such ideas, if they were the student's own would contribute to the merit of his or her own work.

Plagiarism is one of the most serious academic offenses a student can commit. Anyone found guilty will, on the first offense, be given a written warning and an F on the plagiarized work. If the student commits a second offense, an F will be given for the course along with a written warning. A third offense will result in suspension from the program and/or the college.

For further details on this directive, consult the Algonquin College Policy - AA20 and the School of Advanced Technology's Standard Operating Procedure on Plagiarism and Academic Dishonesty.

Respect for Confidentiality

Students are required to respect the confidentiality of employer, client and/or patient information, interactions, and practices that occur either on Algonquin College premises, or at an affiliated clinical/field/co-op placement site. Concerns regarding clients, patients, and/or employer practices are to be brought to the attention of the program coordinator, or designated field/clinical/co-op placement supervisor so that they may be resolved collaboratively. Such concerns are not to be raised publicly either verbally, in writing, or in electronic forums. These matters are to be addressed through established program communication pathways

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 hearings 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 Policy - SA07.

June 15, 2012

The following information is College-wide:

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.

Centre for Students with Disabilities (CSD)

If you are a student with a disability, it is strongly recommended that you identify your needs to the professor and the Centre for Students with Disabilities (CSD) by the end of the first month of the semester in order that any necessary 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 <http://www2.algonquincollege.com/directives/files/2012/04/AA18.pdf> and AA20 <http://www2.algonquincollege.com/directives/files/2011/08/AA20.pdf>

Student Course Feedback*

It is Algonquin College's policy to give students the opportunity to complete a course assessment survey in each course that they take which solicits their views regarding the curriculum, the professor and the facilities. For further details consult Algonquin College Policy AA25 <http://www2.algonquincollege.com/directives/files/2011/10/AA25.pdf>

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 <http://www2.algonquincollege.com/directives/files/2011/11/AA32.pdf>

Transfer of Credit

Students, it is your responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

* College policies (previously called directives) are under review and redesign. The term *directives* is being retired. As such, the policy classification nomenclature is in transition. Students, it is your responsibility to refer to the Algonquin College Directives/Policies website for the most current information available at: (<http://www2.algonquincollege.com/directives/>)