

DC and AC Electronics

Mechanical and Transportation Technology

Course Number: ELN9103	Contribution to Program: Vocational	Normative Hours: 135
Applicable Program(s): 0550X01FWO EME Technician - Robotics	AAL: 1	Core/Elective: Core
Prepared by: Jim Mikolaitis Professor		Approval Date: 28/08/2012
Co-Requisites MAT8050		Approved by: Misheck Mwaba, PhD., P.Eng. Chair, Mechanical and Transportation Technology
Pre-Requisites N/A		Approved for Academic Year: 2012-2013

COURSE DESCRIPTION

Emphasis is placed on labs. Areas of study include what electricity is, how it is produced, voltage, current, power, resistance, how to identify and measure the various components, as well as the relationship between them, the theory of alternating current and its special applications in electronic circuits. Topics covered include RMS, average, applied, peak-to-peak and instantaneous values. Lab experiments deal with RC and RL circuits, transformer characteristics and LC filters. RLC circuits, and series and parallel resonance are also covered.

RELATIONSHIP TO VOCATIONAL LEARNING OUTCOMES

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

EME Technician - Robotics 0550X01FWO

- | | |
|----|--|
| 2 | Interpret and produce electrical, electronic, and mechanical drawings and other related documents and graphics to appropriate engineering standards.(T,A) |
| 3 | Select and use a variety of troubleshooting techniques and test equipment to assess electromechanical circuits, equipment, processes, systems, and subsystems.(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,A,CP) |
| 7 | Analyze, build, and troubleshoot logic and digital circuits, passive AC and DC circuits, and active circuits.(T,A,CP) |
| 14 | Perform all work in accordance with relevant law, policies, codes, regulations, safety procedures, and standard shop practices.(T,A) |
| 15 | Develop personal and professional strategies and plans to improve job performance and work relationships with clients, coworkers, and supervisors.(T) |

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:

- | | |
|----|--|
| 3 | Execute mathematical operations accurately.(T,A,CP) |
| 4 | Apply a systematic approach to solve problems.(T,A,CP) |
| 5 | Use a variety of thinking skills to anticipate and solve problems.(T,A) |
| 8 | Show respect for diverse opinions, values, belief systems and contributions of others. (A) |
| 9 | Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. (A) |
| 11 | Take responsibility for one's own actions, decisions and consequences.(T,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
--	--------------------------------------

<p>1. Define Quantities and Units of DC Circuits</p> <p>Define Voltage, Current and Resistance</p> <p>Define Ohm's Law, Energy and Power</p>	<ul style="list-style-type: none"> Express numbers in terms of scientific and engineering notation Express numbers in terms of metric prefixes Convert back and forth between the above Understand and explain how to practice electrical safety Explain the atom and electrical charge Define and measure voltage, current and resistance in a basic electrical circuit Explain the basic electrical circuit Define and Apply Ohm's Law Explain Energy and Power as they apply to the electrical circuit Explain the power rating of resistors Describe the basic approach to troubleshooting
<p>2. Explain Series, Parallel and Series-Parallel Circuits</p>	<ul style="list-style-type: none"> Explain how resistance, current, voltage and power operate and how they are calculated and measured in a series circuit Explain Ohm's Law and Kirchhoff's Voltage Law in the series circuit including voltage dividers Explain how resistance, current, voltage and power operate and how they are calculated and measured in a parallel circuit Explain Ohm's Law and Kirchhoff's Current Law in the parallel circuit including current dividers Identify and Analyse Series-Parallel Circuits Explain the loading effect of a voltmeter Explain and demonstrate various network theorems
<p>3. Explain Alternating Current and Voltage</p> <p>Explain Capacitors and how they Operate in RC Circuits</p>	<ul style="list-style-type: none"> Explain the Sinusoidal Waveform, demonstrate how to measure both current and voltage from the waveform Explain the Sine Wave Formula as it applies to AC Circuit Analysis Explain and demonstrate Nonsinusoidal Waveforms Demonstrate a working knowledge of the Oscilloscope Identify and explain the basic capacitor types and values and how they operate in series and parallel circuits Explain how capacitors operate in DC versus AC circuits Explain the sinusoidal waveform response as well as impedance and phase angles of Series, Parallel, and Series-Parallel RC Circuits Explain Power in an RC Circuit
<p>4. Define Magnetism and Electromagnetism</p> <p>Define Inductors and RL Circuits</p>	<ul style="list-style-type: none"> Explain the Magnetic Field, Electromagnetism and Electromagnetic Devices Explain Magnetic Hysteresis and Electromagnetic Induction Explain the basic inductor, types of inductors and how they are measured and calculated in Series and Parallel circuits Explain the differences in how inductors react in DC and AC Circuits Explain the sinusoidal waveform response as well as impedance and phase angles of Series, Parallel, and Series-Parallel RL Circuits Explain Power in an RL Circuit
<p>5. Demonstrate RLC Circuits and Resonance</p> <p>Explain the Time Response of Reactive Circuits</p>	<ul style="list-style-type: none"> Explain the sinusoidal waveform response as well as impedance and phase angles of Series, Parallel, and Series-Parallel RLC Circuits

Explain Transformers	<ul style="list-style-type: none"> 1 Define the RC Integrator 1 Explain the Response of RC Integrators and Differentiators to Single and Repetitive Pulses 1 Explain the Response of RL Integrators and Differentiators to Pulse Inputs 1 Define Mutual Inductance and the Basic Transformer 1 Define Step-Up and Step-Down Transformers 1 Explain Loading the Secondary, Reflected Load, and Impedance Matching 1 Explain Tapped and Multiple-Winding Transformers
----------------------	--

LEARNING RESOURCES

<p><u>Electronics Fundamentals: Circuits, Devices and Applications</u> 8th Edition (Required) ISBN: 0135072956 Author: Floyd Pearson, Publisher: Pearson</p> <p><u>Lab Manual for Electronics Fundamentals 8th</u> Edition (Required) ISBN: 0135063272 Author: Buchla Publisher: Pearson</p>
--

LEARNING ACTIVITIES

<p>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 through hands on practical experience. Some peer teaching and collaborative learning may be involved. A complete list of required labs is available on Blackboard.</p>
--

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:
Chapter and Lab Tests 85% (17% for each CLR)	<ul style="list-style-type: none"> 1 Explain Alternating Current and Voltage Explain Capacitors and how they Operate in RC Circuits - [CLR 3] 1 Demonstrate RLC Circuits and Resonance Explain the Time Response of Reactive Circuits Explain Transformers - [CLR 5] 1 Define Magnetism and Electromagnetism Define Inductors and RL Circuits - [CLR 4] 1 Define Quantities and Units of DC Circuits Define Voltage, Current and Resistance Define Ohm's Law, Energy and Power - [CLR 1] 1 Explain Series, Parallel and Series-Parallel Circuits - [CLR 2] 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]
Quizzes 5% 5 Quizzes @ 1% each	<ul style="list-style-type: none"> 1 Explain Alternating Current and Voltage

	<p>Explain Capacitors and how they Operate in RC Circuits - [CLR 3]</p> <p>1 Demonstrate RLC Circuits and Resonance</p> <p>Explain the Time Response of Reactive Circuits</p> <p>Explain Transformers - [CLR 5]</p> <p>1 Define Magnetism and Electromagnetism</p> <p>Define Inductors and RL Circuits - [CLR 4]</p> <p>1 Define Quantities and Units of DC Circuits</p> <p>Define Voltage, Current and Resistance</p> <p>Define Ohm's Law, Energy and Power - [CLR 1]</p> <p>1 Explain Series, Parallel and Series-Parallel Circuits - [CLR 2]</p> <p>1 Execute mathematical operations accurately. - [EES 3]</p> <p>1 Show respect for diverse opinions, values, belief systems and contributions of others. - [EES 8]</p> <p>1 Take responsibility for one's own actions, decisions and consequences. - [EES 11]</p>
<p>Labs 10%</p> <p>(1 Lab Sign Off Sheet worth a total of 10%)</p>	<p>1 Explain Alternating Current and Voltage</p> <p>Explain Capacitors and how they Operate in RC Circuits - [CLR 3]</p> <p>1 Demonstrate RLC Circuits and Resonance</p> <p>Explain the Time Response of Reactive Circuits</p> <p>Explain Transformers - [CLR 5]</p> <p>1 Define Magnetism and Electromagnetism</p> <p>Define Inductors and RL Circuits - [CLR 4]</p> <p>1 Define Quantities and Units of DC Circuits</p> <p>Define Voltage, Current and Resistance</p> <p>Define Ohm's Law, Energy and Power - [CLR 1]</p> <p>1 Explain Series, Parallel and Series-Parallel Circuits - [CLR 2]</p> <p>1 Execute mathematical operations accurately. - [EES 3]</p> <p>1 Apply a systematic approach to solve problems. - [EES 4]</p> <p>1 Use a variety of thinking skills to anticipate and solve problems. - [EES 5]</p> <p>1 Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. - [EES 9]</p> <p>1 Take responsibility for one's own actions, decisions and consequences. - [EES 11]</p> <p>1 Show respect for diverse opinions, values, belief systems and contributions of others. - [EES 8]</p>

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 meter leads. Wait until after first day of classes for more detailed information regarding the tool-kit, BEFORE you purchase any tools.

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

If you are a student with a disability please identify your needs to the professor and/or the Centre for Students with Disabilities (CSD) so that support services can be arranged for you. You can do this by making an appointment at the CSD, Room C142, Ottawa, 727-4723, Ext 7683 or arranging a personal interview with the professor to discuss your needs.

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 publically either verbally, in writing, or in electronic forums. These matters are to be addressed through established program communication pathways.

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/>)