

COURSE OUTLINE

COURSE:	Direct-Current Avionics Systems		
PROGRAM:	280.C0 Avionics techniques		
DISCIPLINE:	280 Aeronautics		
WEIGHTING:	Theory : 2	Practice : 2	Personal study: 2

Teacher(s)	Office	☎ post	✉ email
Chevalier, Mathieu	A-192	4681	mathieu.chevalier@cegepmontpetit.ca
Daigle, Jean-François	A-192	4638	jean-francois.daigle@cegepmontpetit.ca
Desruisseaux, Benoit	A-192	4486	benoit.desruisseaux@cegepmontpetit.ca
Gagnon, Marie-Hélène	A-192	4131	marie-helene.gagnon@cegepmontpetit.ca
Gillard, Pierre	A-187	4552	pierre.gillard@cegepmontpetit.ca
Laurin, Nicholas	A-192	4665	nicholas.laurin@cegepmontpetit.ca
Lavallée, Éric	A-187	4132	eric.lavallee@cegepmontpetit.ca
Leduc, Martin	A-192		martinb.leduc@cegepmontpetit.ca
Levasseur, Jacques	A-187	4399	jacques.levasseur@cegepmontpetit.ca
Morin, Frédéric	A-187	4397	fa.morin@cegepmontpetit.ca
Parenteau, Martin	A-192	4675	martin.parenteau@cegepmontpetit.ca
Richer, Jean-François	A-192	4130	jean-francois.richer@cegepmontpetit.ca
Thibaudeau, Fannie	A-192	4684	fannie.thibaudeau@cegepmontpetit.ca

PERIOD OF AVAILABILITY TO STUDENTS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Department Coordinators	Office	☎ post	✉ email or website
Richer, Jean-François	A-192	4130	jean-francois.richer@cegepmontpetit.ca
Parenteau, Martin	A-192	4675	martin.parenteau@cegepmontpetit.ca

1. PLACE OF THE COURSE IN THE STUDENT'S EDUCATION

This course is offered during the third session of the program.

No course is an absolute prerequisite for this course.

This course is not an absolute prerequisite for any other course. However, this course is part of a program approach. Many of the skills developed in this course will be reinvested in subsequent stages of the program, particularly in the course:

- 280-4A4-EM: Alternate Current Avionics

This course outline should be kept by the student throughout their studies as it will be useful at the time of the integration activity.

Transport Canada: This course outline meets the Transport Canada requirements as outlined in the Training Control Manual (TCM). The department follows the Transport Canada standard of 5% absences from courses (theory and laboratory). The department compiles absences for students enrolled in the *Aircraft Maintenance Techniques* (280.C0) and *Avionics Techniques* (280.D0) programs according to Transport Canada requirements. The application of Transport Canada's policy on the control of absences is available on the [My Success at ÉNA](#) website under the heading "Privileges granted by Transport Canada".

In the event of a conflict between this syllabus and Standard 566 of the Canadian Aviation Regulations or the CFSM, the latter shall prevail.

2. COMPETENCY OF THE GRADUATE'S PORTRAIT

Perform maintenance on aircraft systems.

3. DEPARTMENTAL OBJECTIVE(S) (CODE AND STATEMENT)

025T	To maintain direct-current circuits on an aircraft.
0263	To inspect the operation of simple alternating-current circuits on an aircraft

4. FINAL COURSE OBJECTIVE

At the end of the course, the student will be able to troubleshoot electrical generation and distribution systems on single piston aircraft

5. LEARNING OBJECTIVES

1. Take measurements on DC electrical circuits (series, parallel and mixed).
2. Perform check of passive components on DC electrical circuits.
3. Perform aircraft power supply and distribution system check on DC electrical circuits.
4. Troubleshoot anomalies in aircraft power and distribution systems.

6. COURSE PLANNING

Theoretical part of the course sequence

Course	<u>MODE OF OPERATION</u>			RESOURCES AND TECHNOLOGICAL TOOLS (URL link)
	Objectives	Contents	Learning activities	
1	<p>DC verification on passive components in a wiring diagram.</p> <ul style="list-style-type: none"> Correlate the electrical components on the wiring diagram and their physical counterparts. Analyze an aircraft electrical diagram. Determine the expected functionality of an electrical system from WD examination. Understand the purpose of the Aircraft Maintenance Manual (AMM). 	<p>Identification of the various electrical components</p> <ul style="list-style-type: none"> Recognition of the physical electronic parts, their symbols and designators on the Wiring Diagram. <p>How to read electrical plans</p> <ul style="list-style-type: none"> Recognition of the parameters of a Wiring Diagram Recognitions of electrical components, wire types and connectors (P – Plugs and J – Jacks) Manufacturer informations localisation The ATA system 	<ul style="list-style-type: none"> Course Outline lectured presentation Group discussion on the Power Generation schematic for a Single Engine DC System Lectured presentation on the use and meaning of a WD and an AMM Individual identification exercise of various physical electrical components Team identification exercise of various electrical components in an aircraft electrical schematic 	<ul style="list-style-type: none"> PowerPoint (LÉA) Homeworks (LÉA) Video Other applicables ressources
2	<p>DC Verification of the electrical power supply system on the Single engine mock-up WD:</p> <ul style="list-style-type: none"> Analyze the Single Engine electrical distribution system. Determine the purpose and functioning of passive components. Determine the current direction through the system (conventional current). 	<p>Aircraft technical manuals</p> <ul style="list-style-type: none"> The different maintenance manuals and their usage <p>Electrical control components in a wiring diagram</p> <ul style="list-style-type: none"> Switch Relay Contacteur <p>Follow the electric signal from source to the ground.</p> <ul style="list-style-type: none"> Sources (Battery and GPU) Ground points 	<ul style="list-style-type: none"> Lectured presentation and group discussion on the control devices in an electric circuit. Lectured presentation and group discussion on the power generation control devices Groupe exercise on the signal tracing on the mock-up Wiring Diagram <i>MP-A113</i> Team scenario on open/closed circuits 	
3	<p>Take DC measurements of DC electrical circuits (serial, parallel, mixed) with the Ohm law:</p> <ul style="list-style-type: none"> Notions of power and energy. Serial circuits. Parallel circuits. Power Sources (Generators and Batteries). 	<p>Ohm law</p> <ul style="list-style-type: none"> Relationship between voltage, resistance and current <p>Definitions of electric parameters and their units</p> <ul style="list-style-type: none"> Power, Energy <p>Kirchhoff law.</p> <ul style="list-style-type: none"> Identification of serial, parallel and mixed circuits. 	<ul style="list-style-type: none"> Revisions of concepts Lectured presentations Team activities Exercices Homeworks 	

Course	MODE OF OPERATION			RESOURCES AND TECHNOLOGICAL TOOLS (URL link)
	Objectives	Contents	Learning activities	
4	<p>The Ohm law:</p> <ul style="list-style-type: none"> Mixed circuits. <p>Relationship between electric potential, current and electrical resistance; definition of an electrical current</p> <ul style="list-style-type: none"> Origins of electricity. Current flow. Current types. Electricity conductors. Static electricity. <p>Definition of the electric parameters and their measurement units:</p> <ul style="list-style-type: none"> Voltage, current and resistance notions. 	<p>Application of Ohm and Kirchhoff laws to electrical circuits.</p> <ul style="list-style-type: none"> Identification of serial parallel and mixed circuits. Determination of total resistance of serial circuits. <p>Electric junction/link components.</p> <ul style="list-style-type: none"> Plug Connector Terminal block Shunt 	<ul style="list-style-type: none"> Revisions of concepts Lectured presentations Team activities Exercices Homeworks 	
5	<p>Perform DC Power Supply and protection device check.</p> <ul style="list-style-type: none"> Analyze the single engine electrical supply with a battery or a ground power unit (GPU). Determine the role and functionality of passive control components. Determine the current direction through the system (conventional current). 	<p>Electrical circuit protection components</p> <ul style="list-style-type: none"> Fuse Breaker <p>Resistance of a circular wire.</p> <ul style="list-style-type: none"> Conductor resistance Types of conductors used in aeronautics and their characteristics: AC 43.13-1B and AC 43.13-2A. Choice of a wire gauge based on voltage, current and distance from the source. 	<ul style="list-style-type: none"> Revisions of concepts Lectured presentations Team activities Exercices Homeworks 	
6	<p>Theoretical evaluation of the concepts acquired in courses 1 to 5 (20%)</p>			<p>Review of documents, exercises and assignments.</p>
7	<p>Take DC measurements of DC electrical circuits (serial, parallel, mixed) with power supply and batteries:</p> <ul style="list-style-type: none"> Electrical power supply (Generators and Batteries) Notion of power and energy. Power supply in serial and parallel configuration. Battery types and characteristics. 	<p>Types and characteristics of batteries used in aviation.</p> <ul style="list-style-type: none"> Lead-acid batteries Nickel-Cadmium batteries Lithium-ion batteries <p>Maintenance manual.</p>	<ul style="list-style-type: none"> Revisions of concepts Lectured presentations Team activities Exercices Homeworks 	<ul style="list-style-type: none"> PowerPoint (LÉA) Homeworks (LÉA) Video Other applicables ressources

Course	MODE OF OPERATION			RESOURCES AND TECHNOLOGICAL TOOLS (URL link)
	Objectives	Contents	Learning activities	
8	<p>Take DC measurements of DC electrical circuits (serial, parallel, mixed) with semi-conductors:</p> <ul style="list-style-type: none"> • Notion of power and energy. • Serial circuits. • Parallel circuits. • Electrical power supply (Generators and Batteries). <p>Verification of a single engine aircraft DC supply and distribution system.</p> <p>Verification of the DC generation system functionality.</p> <p>Verification of the single piston engine DC generation system.</p>	<p>Semi-conductors</p> <ul style="list-style-type: none"> • N, P-type materials, PN junctions and polarization of PN junctions. • Recognizing the symbol for diodes. • Functions of diodes <ul style="list-style-type: none"> • Switching circuits • Free-wheel circuits • LED • Photodiodes • Zener Diodes • Electromagnetism. • Application of electromagnetism. • Electromagnetic induction. <p>DC electrical machines</p> <ul style="list-style-type: none"> • DC electrical motor 	<ul style="list-style-type: none"> • Revisions of concepts • Lected presentations • Team activities • Exercices • Research on batteries 	<ul style="list-style-type: none"> • PowerPoint (LÉA) • Homeworks (LÉA) • Video • Other applicables ressources
9	<p>Check the power supply and distribution system: starter and alternator.</p> <p>Perform Aircraft DC Power Supply and DC Distribution System Check.</p> <p>Check operation of DC generation systems</p> <p>Check a DC generation system of a single piston engine.</p>	<p>DC electrical machines (continued)</p> <ul style="list-style-type: none"> • DC alternator • Starter-Gen • Analysis (using schematics of a single-engine piston aircraft): <ul style="list-style-type: none"> • Electrical power generation and distribution system. • Starting system. 	<ul style="list-style-type: none"> • Revisions of concepts • Lected presentations • Team activities • Exercices • Homeworks 	
10		<ul style="list-style-type: none"> • Voltage regulator 		
11	<p>Troubleshoot anomalies in the DC generation and distribution system of a single piston engine.</p>	<p>Generation, distribution and starting systems for single piston engines.</p>	<ul style="list-style-type: none"> • Revisions of concepts • Lected presentations • Team activities • Exercices • Homeworks 	
12		<ul style="list-style-type: none"> • Analysis (using schematics of a single-engine piston aircraft): <ul style="list-style-type: none"> • Electrical power generation and distribution system. • COMPLETE electric supply system analysis 		
13				
14		<p>Troubleshooting techniques</p> <ul style="list-style-type: none"> • Using test procedures. • Using Wiring Diagram • Using test points 		
15	<p>Theoretical evaluation of the concepts acquired in courses 1 to 14 (40%)</p>			<p>Review of documents, exercises and assignments.</p>

Sequence of the practical part of the course

Course	MODE OF OPERATION			RESOURCES AND TECHNOLOGICAL TOOLS (URL link)
	Objectives	Contents	Learning activities	
1	Take measurements on direct current electrical circuits. Perform DC Verification of Passive Components: <ul style="list-style-type: none"> • Operation of electrical control devices. • Operation of electrical protective devices. 	Presentation of the course outline and sequence <ul style="list-style-type: none"> • Avionics Laboratory Safety Concepts • Recall of power of 10 • Resistance Color Code • Resistance measurement 	<ul style="list-style-type: none"> • Workshop familiarization • Workshop experiments 	<ul style="list-style-type: none"> • PowerPoint (LÉA) • Laboratory documents (LÉA) • Electrical components • Training board and didactic panels
2		<ul style="list-style-type: none"> • Principle and use of an analog multimeter • Principle and Use of a Digital Bench Multimeter • Principle and use of a portable digital multimeter • Measurement of resistors, relays and switches • circuit breakers and fuses 		
3		<ul style="list-style-type: none"> • Construction and measurement of electrical circuits 1 		
4		<ul style="list-style-type: none"> • Construction and measurement of electrical circuits 2 		
5	Practical Assessment 1 Analysis and verification of simple electrical components and circuits			
6	Perform Aircraft DC Power Supply and Distribution System Check.	<ul style="list-style-type: none"> • Explanation and demonstration of how to use the ground power unit with the mockup. • Use of mockup as operator • Use of AMM to perform maintenance checks (block 500). 	<ul style="list-style-type: none"> • Workshop experiments Studied systems: <ul style="list-style-type: none"> - Anticollision - Position light - Landing light - Fuel indication system. - Starter system 	<ul style="list-style-type: none"> • Laboratory documents (LÉA) • PowerPoint (LÉA) • Single-engine didactic mockup (MP-A113) • Mockup technical documentation • Troubleshooting form (LÉA)
7				
8				
9				
10	Practical Assessment 2 Individual battery maintenance scenario			
11	Troubleshoot anomalies in the DC generation and distribution system of a single piston engine.	<ul style="list-style-type: none"> • Troubleshooting of the single engine mockup (MP-A113) using the voltmeter or ohmmeter in accordance with the 14 V Single Piston Engine Procedures Manual (AMM) 	<ul style="list-style-type: none"> • Team troubleshooting exercises on mock-up MP-A113 	
12				
13				
14				
15	Practical Assessment 3 Individual troubleshooting of an aircraft system			

7. SUMMATIVE EVALUATION PROCEDURES

Course of the theoretical part of the course

Deadline (date)	Description of the evaluation activity	Context of realization and mode of evaluation	Learning objective(s)	Evaluation criteria	Weight (%)
Week 6	Exam 1 Identification and analysis of basic electrical components and circuits. Determination of DC electrical circuit parameters.	<ul style="list-style-type: none"> ✓ Questionnaire provided in class at time of review. ✓ Development questions dealing with scenarios. ✓ no documentation ✓ individual 	1, 2, 3	<ul style="list-style-type: none"> - Accuracy of calculations - Diagnostic accuracy - Accuracy of methodology applied 	20
Week 15	Exam 2 Theoretical analysis, verification and troubleshooting of aircraft electrical systems. Determination of DC electrical circuit parameters.	<ul style="list-style-type: none"> ✓ Questionnaire provided in class at time of review. ✓ Development questions dealing with scenarios. ✓ no documentation ✓ individual 	1, 2, 3, 4	<ul style="list-style-type: none"> - Accuracy of calculations - Diagnostic accuracy - Accuracy of methodology applied 	40

Subtotal: 60%.

Conduct of the practical part of the course

Deadline (date)	Description of the evaluation activity	Context of realization and mode of evaluation	Learning objective(s)	Evaluation criteria	Weight (%)
Week 5	Practical assessment 1 Verification of DC electric circuits containing passive components	<ul style="list-style-type: none"> ✓ Individual evaluation on didactic panel ✓ Electrical circuit to be made according to a drawing provided ✓ Perform electrical measurements according to the provided evaluation workbook 	1, 2	<ul style="list-style-type: none"> - Appropriate use of technical information - Compliance of technical verification operations - Circuit accuracy - Compliance of technical operations when taking measurements 	10
Week 10	Practical assessment 2 Summative workshop on the concepts of aircraft battery maintenance	<ul style="list-style-type: none"> ✓ Individual evaluation on didactic panel ✓ Verification of the needs and resources ✓ Individual preparation (research-type) to be prepared by the student before the practical assessment ✓ Validate the information with the maintenance guide 	3	<ul style="list-style-type: none"> - Correct battery characterization - Correct description of the maintenance requirements - Precise description of battery handling and stocking in accordance with the maintenance guide 	5

<p>Week 15</p>	<p>Practical assessment 3 Analysis, verification and troubleshooting of DC primary generation aircraft equipped with DC generators</p>	<ul style="list-style-type: none"> ✓ Individual evaluation on didactic panel ✓ Verification and Troubleshooting ✓ 1 malfunction placed by the teacher for evaluation purposes ✓ List of tests to be performed provided in class ✓ Perform tests according to a procedure provided, in order to validate the compliance of the unit 	<p>3, 4</p>	<ul style="list-style-type: none"> - Appropriate use of technical information - Compliance of technical verification operations - Precise description of the observed anomaly - Accurate assessment of symptoms - Precise identification of probable causes - Judicious planning - Compliance of technical operations when taking measurements - Precise identification of the cause of the anomaly - Clarity of troubleshooting conclusion 	<p>25</p>
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Subtotal : 40%

TOTAL : 100%

Extracurricular activities of an aeronautical nature.

In order to increase their knowledge of the aviation environment, the Avionics Department strongly advises students to actively participate in the development of and take part in any extracurricular activities of an aeronautical nature such as visits (industries, operators, airports, air traffic management, military bases, museums, theme parks, etc.), conferences or events organized both within and outside the National School of Aerotechnics.

8. MANDATORY EQUIPMENT REQUIRED

Safety clothing and equipment in accordance with ÉNA standards.

EISMIN, THOMAS K. – *Aircraft Electricity & Electronics, *7th Edition*, McGraw-Hill, 2019. ISBN 978-1-260-10821-7 (paper version strongly recommended)

9. BIBLIOGRAPHY

EISMIN, THOMAS K. – *Aircraft Electricity & Electronics, *7th Edition*, McGraw-Hill, 2019. ISBN 978-1-260-10821-7

10. CONDITIONS FOR SUCCESS IN THE COURSE

(1) Note of passage

The passing grade for a course is 60% (PIEA, section 5.1m).

(2) Attendance at summative evaluations

Attendance at summative evaluation activities is mandatory (IEP, section 5.2.5.1).

(3) Delivery of the work

Work required by a professor must be submitted on the date, place, and time specified. Penalties for tardiness are established according to departmental rules (PIEA, section 5.2.5.2).

Penalties for late work are: *Unless agreed upon with the instructor, late work is penalized at a rate of 10% per day late, and a grade of zero will be assigned to the work beginning on the sixth day late. Work required by week 15 may not be turned in late.*

See the "Departmental Rules" section at: <https://mareussite.cegepmontpetit.ca/ena/mon-parcours/mon-programme/regles-departementales/>

(4) Material presentation of the work

The student must respect the "Normes de présentation matérielle des travaux écrits" adopted by the Cégep. These standards are available at <http://rmsh.cegepmontpetit.ca/normes-de-presentation-materielle-des-travaux-ecrits-du-cegep/>.

Penalties for failure to meet standards are: *When an assignment turned in is deemed unacceptable due to presentation, grading of that assignment will be delayed until the assignment is turned in within the standards set by the instructor. In this case, the penalties for late submission of work will apply.*

See the "Departmental Rules" section at: <https://mareussite.cegepmontpetit.ca/ena/mon-parcours/mon-programme/regles-departementales/>

(5) Quality of the French language

The assessment of language quality (PIEA, section 5.3.1) must meet the criteria and values established by the department. The departmental procedure for evaluating the quality of French is:

<https://mareussite.cegepmontpetit.ca/ena/mon-parcours/mon-programme/regles-departementales/>

11. HOW TO PARTICIPATE IN THE COURSE

Laboratory Safety and Use of Premises:

Student occupancy of laboratory space and use of laboratory equipment must be under the supervision of a professor or technician, unless otherwise specified.

Any student whose behavior in the lab presents a risk to others present will, after warning by the instructor, be excluded from the lab until the case is reviewed by the instructor and the Avionics Department Coordinator.

Safety glasses and shoes must be worn by all (faculty and students) for all lab sessions, whether the session is in the workshop, the hangars, or one of the school's technical libraries.

Students are encouraged to consult the website for rules specific to this course:

<https://mareussite.cegepmontpetit.ca/ena/mon-parcours/mon-programme/regles-departementales/>

As stated in Section 5.3.4 of the PIEA, attendance is evidence of the student's commitment to his/her studies. The instructor must record absences in the electronic absence management system or on a logbook for the student to review.

12. INSTITUTIONAL POLICIES AND RULES

All students enrolled at the École nationale d'aérotechnique of Cégep Édouard-Montpetit must be aware of the content of certain institutional policies and regulations and comply with them. These include the Institutional Policy on the Evaluation of Learning (PIEA), the Institutional Policy on the French Language (PILF), the Policy for a Harassment and Violence-Free Learning and Working Environment (PPMÉTEHV), the Conditions of Admission and Academic Progress, and the Procedure for Handling Student Complaints in the Context of Educational Relations.

The full text of these policies and regulations is available on the College's website at <http://www.cegepmontpetit.ca/ena/a-propos-de-l-ecole/reglements-et-politiques>. In the event of a discrepancy between the texts appearing elsewhere and the full text, the latter is the only legal and applied version.

APPENDIX

None.