Collège
Édouard-Montpetit
École nationale d'aérotechnique

280-3D4-EM
FALL 2010
Avionics

COURSE OUTLINE

COURSE: **Direct-Current Avionics Systems**

PROGRAM: 280.C0 Aircraft Maintenance Technology

DISCIPLINE: 280 Aeronautics

WEIGHTING: Theory: 2 Practical Work: 2 Personal Study : 2

Instructor(s)	Office	☎ extension	✉ e-mail or website
Boyer, Serge	A-192	4546	serge.boyer@college-em.qc.ca
Boileau, Michel	A-192	4685	michel.boileau@college-em.qc.ca
Dagher, Maya	A-192	4682	maya.dagher@college-em.qc.ca
Dubois, Marcel	A-192	4680	marcel.dubois@college-em.qc.ca
Gere, Andrei	A-187	4649	andrei.gere@college-em.qc.ca
Gillard, Pierre	A-187	4552	pierre.gillard@college-em.qc.ca
Gosselin, Raymond	A-187	4650	raymond.gosselin@college-em.qc.ca
Lemoyne, Pierre	A-192	4681	pierre.lemoyne@college-em.qc.ca
Rădulescu, Andrei	A-187	4648	andrei.radulescu@college-em.qc.ca
Rivière, Frantz	A-192	4675	frantz.riviere@college-em.qc.ca
Trần, Quốc Túy	A-187	4232	quoctuy.tran@college-em.qc.ca

OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinator(s)	Office	☎ extension	✉ e-mail or website
Gosselin, Raymond	A-187	4650	raymond.gosselin@college-em.qc.ca
Rivière, Frantz	A-192	4675	frantz.riviere@college-em.qc.ca

CONTEXT OF THIS COURSE IN THE PROGRAM

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

By the end of the course, students will be able to use their understanding of electrical systems to acquire other skills in electricity and aircraft electronics.

This course is an absolute prerequisite for 280-533-EM.

Students must keep this course outline for the duration of their studies as it will be useful for the comprehensive assessment at the end of the program.

MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

025T To maintain direct-current circuits on an aircraft.
(Training time: 100 class periods)

Distribution of Competence O25T in the program:

►	3rd session	280-354-EM:	Direct-Current Avionics Systems	55 periods of 100
	4th session	280-404-EM:	Direct-Current Avionics Systems	30 periods of 100
	6th session	280-533-EM:	Avionics Maintenance	15 periods of 100
	Total:			100 periods

0263 To verify simple alternating-current circuits on an aircraft.
(Training time: 70 class periods)

Distribution of Competence O263 in the program :

►	3rd session	280-354-EM:	Direct-Current Avionics Systems	5 periods of 70
	4th session	280-404-EM:	Direct-Current Avionics Systems	30 periods of 70
	4th session	280-605-EM:	Aircraft Instrumentation	5 periods of 70
	6th session	280-533-EM:	Avionics Maintenance	30 periods of 70
	Total:			70 periods

TEACHING AND LEARNING STRATEGIES

Theory:

The theoretical course will be delivered in a lecture format with multimedia support when possible and appropriate. Among others, simulation software such as *Multisim* will be used to quickly simulate circuit operation.

Practical Work:

Acquisition of the theoretical knowledge will be facilitated by a series of experiments divided into 15 laboratory sessions.

COURSE PLAN

025T To maintain direct-current circuits on an aircraft.

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
#1. Take measurements on : - series ciruits - parallel circuits - series-parallel circuits	THE STRUCTURE OF MATTER 1. Define the basic elements of the structure of matter - identify the internal organisation of the atom; atomic forces - distinguish atoms and ions		Study: Read corresponding chapters in the text. Homework: Solve problems.	Appendix C Part 2 22.1.1 22.1.10
	STATIC LOADS 2. Plot the forces exerted on electrical charges on a Cartesian plane.	Maximum of 2 charges		
	3. Explain the effect of electrical field on a charge in space.			
	4 Explain the relationship between electrical field and potential energy of an electric charge.			
	5. Define the concept of electric potential.			
	6. Explain the means of protection against static electricity used in an aircraft.	• Bonding: metal braids between moving surfaces, grounding, etc. • Static dischargers	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Labs 1 to 5	Appendix C Part 2 22.3.29
	7. Check the installation of static dischargers and the presence and condition of protection braids on moving surfaces.	(Must be done only in the laboratory)		
	MOVING CHARGES 8. Find relationships and differences between the concepts of power and energy.	• Concept of energy • Concept of power		
	9. Define the concept of electrical current.			
	10. Define the quantities used in electricity and identify their units of measure.			Appendix C Part 2 22.1.4
	11. Define the relationship between the electric potential difference, current and electric resistance.	• Ohm's Law		Appendix C Part 2 22.1.7
	12. Identify methods used to produce electrical energy onboard aircraft.			Appendix C Part 2 22.1.5
#1. Take measurements on: - serie	13. Describe the characteristics of resistance.	• Definition of resistance, unit used and sub-multiples • Colour code of resistors and power rating • Types of resistance: fixed, variable, adjustable	Study: Read corresponding chapters in the text. Homework: Solve problems.	

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
	14. Identify types of electrical circuits on aircraft.	• Two-wire and single-wire electrical systems • Concept of ground on an aircraft	Practical Work: Labs 1 to 5	
	15. Solve a simple circuit made up of two or more resistors, in series and in parallel.	• Definition and characteristics of a series circuit and a parallel circuit • Explanation of an equivalent circuit • Calculating the equivalent resistance of two or more resistors in series or in parallel • Relationships between current in each resistor and the current supplied by the source • Relationships between potential difference at the terminals of each resistor and the potential difference at the source		Appendix C Part 2 22.1.6
#1. Take measurements on : - series ciruits - parallel circuits - series-parallel circuits	16. Solve a mixed circuit (series-parallel)	• Definition and characteristics of a mixed circuit • Explanation of an equivalent circuit • Calculating the equivalent resistance of a mixed circuit • Relationships between current of each resistor and the current supplied by the source • Relationships between potential difference at the terminals of each resistor and the potential difference at the source	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Labs 1 to 5	Appendix C Part 2 22.1.6
	17. Use a multimeter as: voltmeter, ammeter and ohmmeter.	• Correctly connect simple electrical circuits using components identical to those used in prior calculations. • Correctly connect the analog multimeter in voltmeter, ohmmeter and ammeter. • Assess the deviation of the analog multimeter for measuring voltage, current and resistance.	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Labs 1 to 5	Appendix C Part 2 22.1.12 22.1.6

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
#1. Take measurements on : - series ciruits - parallel circuits - series-parallel circuits	18. Check a faulty circuit with a multimeter.	• The simple circuit is provided in the lab with a few resistors mounted on a panel. The theoretical schematics are provided; students must then: - Analyse the circuit - Record the values of current and voltage for each circuit resistor - Troubleshoot the circuit • The circuit used can be any simple aircraft circuit, on the aircraft itself. The malfunction will be open circuit or short circuit. The sequence and requirements are as described in 1.17.1.	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Labs 1 to 5	Appendix C Part 2 21.1.12
#2. Verify the direct current of passive components.	1. Explain the factors that affect the resistance of a circular lead wire.	• Definition of the resistivity of a conductor • Characteristics of Imperial (UK) and International Measurement Systems; definition of a circular mil • Change in resistance with temperature • Types of conductors used in aeronautics and their characteristics: AC 43.13-1B and AC 43.13-2A • Selecting appropriate wire gauge • Maximum allowable voltage drops • Selecting the size of the circuit-breaker and the fuse to use • Selecting the rating of the switch to use	Study: Read corresponding chapters in the text. Homework: Solve problems.	Appendix C Part 2 22.3.3, 22.3.4, 22.3.28
	2. Check the operation of various control devices used in circuits: - All types of switches - Various types of relays	• Main characteristics • Using the multimeter to check all configurations as separate components and in a circuit.	Study: Analyse selected schematics in the text *Aircraft Electrical Systems, Single and Twin Engine*	Appendix C Part 2 22.1.8, 22.1.19, 22.3.1
	3. Check the operation of various protective devices: temperature, pressure, light and position transducers	• Analysis of indicating and monitoring circuits: - Smoke and fire detection systems - De-icing and anti-icing systems - Fuel level indication systems - Landing gear control systems		Appendix C Part 2 22.3.6, 22.3.10, 21.1.1, 20.0.3, 19.0.2, 17.0.3

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
	4. Check the operation of various protective devices.	• Operation of fuses • Operation of various types of circuit breakers		22.3.13, 22.3.14, 22.1.8, 22.1.19, 22.3.7
	5. Interpret plans and diagrams involving semi-conductor components.	• N, P type materials, PN junction and polarizations of the PN junction • Recognizing the diode symbol • Functions of the diode - Rectifying circuits - Free-wheel circuits - LED - photodiode • other functions of the diode	Study: Analyse selected schematics in the text *Aircraft Electrical Systems, Single and Twin Engine*	
#3. Verify the direct-current electrical power supply and distribution system of an aircraft.	1. Check the operation of a DC generator	• Principle of electrical current production and the components of a DC generator : - Basic concept of electro-magnetism - Generators - D.C. output alternator • Generator control and analyzing devices used to accomplish these tasks: - monitoring - voltage regulator with passive components - current limiter with passive components - reverse current cut-out relay with passive components - overvoltage protection with passive components • D.C. generators maintenance and troubleshooting procedures	Study: documentation handed out by the instructor	22.1.17, 22.3.8, 22.3.17, 22.3.19, 22.3.8, 22.3.21 22.3.41 22.3.45
#3. Verify the direct-current electrical power supply and distribution system of an aircraft.	2. Check the operation of a D.C. electric motor.	• Operation of a DC motor • Aeronautical applications of DC motors : - starter - starter-generator - control surfaces actuator motor • DC motors maintenance and troubleshooting procedures	Study: documentation handed out by the instructor	22.1.9, 22.1.17, 22.3.2, 22.3.12, 22.3.25, 22.3.44, 22.3.45

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
	3. Check a DC generation system of a single engine piston aircraft	• Inspection of the following: (NB: for this competence, the inspection is limited to carrying out a test procedure) - Aircraft battery power -up - Aircraft GPU power-up - Aircraft alternator power -up - Operation of the overvoltage protection devices - Low speed voltage regulation - Cruise speed voltage regulation - Achieving a fixed point on a single engine piston aircraft		
#3. Verify the direct-current electrical power supply and distribution system of an aircraft.	4. Check a DC generation system on a single engine turbine aircraft.	• Inspection of the following: (NB: for this competency, the inspection is limited to carrying out a test procedure) - Battery and GPU aircraft power -up - Starter/generator aircraft power-up (regulator, reverse current cut-out relay etc as separate devices) - Starter/generator aircraft power -up - Interlock circuits - Overvoltage protection devices - Voltage regulation	Study: documentation handed out by the instructor	22.3.9 22.3.27 22.3.41 22.3.42 22.3.45
	4. Check a DC distribution system of a single engine piston and a single engine turbine aircraft while respecting safety procedures.	• Inspection of the following: - Electrical distribution protection devices - circuit-breakers - fuses - Electrical distribution control devices - switches - relays - aircraft or simulator electrical devices - wiring		22.3.5 22.3.15 22.3.27 22.3.30

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
	5. Diagnose malfunctions in the DC generation and distribution of a single engine piston and a single engine turbine.	• Identification of defects by comparing the expected operation and the actual operation of the aircraft's electrical generation system.		22.3.27 22.3.34 22.3.45
#5. Test the operation of lead-acid batteries.	1. Describe in general the principle of chemical reactions that occur in the lead-acid batteries while charging and discharging.	• Conclusions from chemical reactions on inspection methods of lead-acid batteries	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Lab 13	22.3.16
	2. Explain the procedure for handling lead-acid batteries.	• Precautions to take such as: - handling lead-acid batteries in the battery shop - handling lead-acid batteries on an aircraft • Corrective measures to take in case of an accident with lead-acid batteries: - for people - for aircraft • Installation and removal of a battery respecting safety regulations		22.3.38

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
	3. Explain the steps in the initial operation of a lead-acid battery.	• Battery filling • Filling cells with electrolyte • Charging • Checking the electrolyte density • Adjusting the electrolyte level • Checking cell caps • Battery initial operation logbook tracking		22.3.35

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
#5. Test the operation of lead-acid batteries.	4. Explain the procedure for complete maintenance of a lead-acid battery.	• Preliminary checks: - inspect electrolyte consumption; check overall history - electrolyte density in each cell (differences between readings) - clean and inspect caps • Charging the battery: - adjust the charge current limit - check the steam and gas exhaust systems - check charging time • Checking capacity - by measuring electrolyte density - by controlled discharge - determining airworthiness • Second charging of the battery: - adjust the charge current limit - checking exhaust systems - checking charging time • Return to service: - inspecting cell caps - checking electrolyte density - adjusting electrolyte level - cleaning exterior - recording open circuit (OCV) and closed circuit (CCV) performances	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Lab 13	
#7. Determine the charge balance of a direct-current circuit in an aircraft.	1. Identify information relevant to the electrical load analysis for a single engine aircraft: - AC 43 13 - FAR 23 - JAR 23 - Manufacturer's manuals	• Type of monitoring • Capacity of electrical generation system • Calculation of maximum allowable electrical load • Calculation of the actual electrical load • Measuring the actual electrical charge • Conclusions on the aircraft's electrical load report	Study: documentation handed out by the instructor	
	2. Identify regulations concerning the mandatory need to perform a new electric load analysis	•		

0263 To inspect the operation of simple alternating-current circuits on an aircraft

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
#1 Describe in general the principle of chemical reactions that occur in nickel cadmium batteries while charging and discharging.	1. Make conclusions from chemical reactions regarding inspection methods that cannot be used with nickel cadmium batteries.		Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Lab 13	22.3.16
	2. Explain the procedure for handling nickel cadmium batteries.	• Precautions to take to avoid accidents • Corrective measures to take in case of an accident with nickel cadmium batteries: - for people - for aircraft • Installation and removal of a battery respecting safety regulations		22.3.37

Élement of the Ministerial Objective	Learning Objective	Content	Personal Study Activities	Transport Canada Reference
#1 Describe in general the principle of chemical reactions that occur in nickel cadmium batteries while charging and discharging.	3. Explain the maintenance procedure for a nickel cadmium battery.	• Discharging the Ni-Ca battery: - controlled discharge and short-circuiting of the low voltage cell terminals - cleaning cells and trays - reinstallation • Charging the nickel cadmium battery: - check steam and gas exhaust systems - check charging time - constant current charging- • Battery inspection - perform controlled discharge and short-circuiting of the low voltage cell terminals. - determine airworthiness of each cell - replace defective cells • Second charging of the battery: - adjust charging current limit - check charging time - check temperature • Return to service - inspect cell caps - adjust electrolyte level - clean exterior • Inspection of the Ni-Ca battery temperature detection circuit on an aircraft.	Study: Read corresponding chapters in the text. Homework: Solve problems. Practical Work: Lab 13	22.3.36

Session Calendar:

Theory:

Periods		Content		Personal Study	Objectives
Week 1	1 per	Introduction to the course	• Course Outline		
	1 per	Structure of Matter Static Charges	▪ Structure of atoms ▪ Conductors, insulators and semi-conductors ▪ Definition of coulomb units ▪ Explanation of the use of static dischargers and bonding braids on an aircraft.	Study: • Chap. 1 (pp. 1-6), chap. 4 (pp. 77-78) and chap. 13 (pp. 261-263) of the reference manual. Homework: • Selected problems to hand in Week 2	#1.1 to #1.7 (025T)
Weeks 2 to 4	6 per	Concepts of voltage, current and resistance Ohm's Law Concepts of power and energy Series circuits Parallel circuits Explanation of an equivalent circuit Mixed circuits	▪ Definition of voltage ▪ Sources of voltage ▪ Definition of current ▪ Definition of resistance ▪ Types of resistors used in aircraft circuitry ▪ Common components of an electrical circuit (relay, switch, fuse, lamp) ▪ Identification of a series circuit. Circuits of anti-collision lights, gas levels and others will be explained. ▪ Voltage in a series circuit ▪ Current in a series circuit ▪ Equivalent resistance –series ▪ Power in a series circuit ▪ Laws applied to series circuits ▪ Identification of a parallel circuit. The circuits of navigation lights, landing lights and others will be explained. ▪ Voltage in a parallel circuit ▪ Current in a parallel circuit ▪ Equivalent resistance --parallel ▪ Power in a parallel circuit ▪ Laws applied to parallel circuits ▪ Identification in a mixed circuit of the relationships in series and in parallel ▪ Total current of a mixed circuit; current in the branches. ▪ Equivalent resistance in a mixed circuit ▪ Examples of simple malfunctions in parallel series circuits	Study: • Chap. 2, chap. 6 (pp. 100-102), and chap. 13 (pp. 263-269) of the reference manual. Homework: • Selected problems to hand in Week 5	#1.6 to #1.16 (025T)
Week 5	2 per.	Resistance of a circular lead wire	▪ Resistance of conductors ▪ Types and characteristics of conductors used in aeronautics: AC 43.13-1B and AC 43.13-2A ▪ Definition of a circular mil ▪ Selecting a gauge of wire according to the criteria of voltage, current and distance from the source. ▪ Protection devices	Study: • Chap. 4 (pp. 56-66) and chap. 6 (pp. 95-100) of the referrence manual Homework: • Selected problems to hand in Week 6	#2.1 (025T)

Periods		Content		Personal Study	Objectives
Week 6	2 per.	Semi-conductors	• N, P–type materials, PN junctions and polarization of PN junctions • Recognizing the symbol for diodes (rectifiers) • Functions of diodes - Rectifying circuits - Free-wheel circuits - LED - photodiodes ▪ Other functions of the diode (Rectifier circuits will be studied in the course 280-404)	Study: • Chap. 6 (pp. 110-113, 121) of the reference manual Homework: • Selected problems to hand in Week 7	#2.5 (025T)
Week 7	2 per	Test 1 (20 points)			#1.1 to #1.16 (025T)
Weeks 8 to 10	6 per.	DC electrical machines	Qualitative study of : • Concepts of electromagnetism ▪ DC output alternator ▪ DC generator ▪ Voltage regulator ▪ DC motor ▪ Starter Generator	Study: • Chap. 1 (pp. 6-12), chap. 9 (pp. 175-182, 188), chap. 10 (pp. 190-199, 208) and chap. 11 (pp. 210-214) of the reference manual Homework: • Selected problems to hand in Week 11	#2.5 (025T)
Weeks 11 to 13	6 per.	Power generation, distribution and starting systems for piston and turbine single engines.	▪ Using diagrams of a single-engine piston aircraft (Cessna 172 and other examples) make an analysis : - of the power generation and distribution system of electrical energy - of the starter system ▪ Using diagrams of a single-engine turbine aircraft (Bell 206 and other examples) make an analysis of: - the power generation and distribution system of electrical energy - starting system ▪ Explain the electrical load analysis on an aircraft.	Study: • Analyse diagrams of aircraft single-engine pistons and single-engine turbine. Homework: • Review diagrams of aircraft single-engine pistons and single-engine turbine.	#5.1 (025T) #1.1 (0263)
Week 14	2 per.	Batteries	▪ Lead-acid batteries ▪ Nickel-Cadmium Batteries ▪ Principle of chemical reactions	Study: • Chap. 3 of the reference manual Homework: • Selected problems to hand in Week 15 • Theory Review	#2.2 (025T) #2.3 (025T) #2.5 (025T)

Periods		Content	Personal Study	Objectives
Week 15	2 per	Final Test (30 points)		ALL

Practical Work:

Periods		Content		Personal Study	Objectives
Week 1	2 per	Introduction to the course	- Safety concepts in the avionics laboratory - Digital Multimeter: Explanation of the voltmeter. Measuring DC voltage on a power supply and batteries.		#1.17 (025T)
Week 2	2 per	Static dischargers and bonding braids	In the hangar : Students will locate bonding braids and dischargers on the following aircraft : Cessna, Piper, Aerocommander, Beechcraft 90, Bell 206 and Astar 350.	Laboratory Preparation: Review relevant course notes Laboratory Reports: Complete the report with data found in the hangar	#1.6 (025T) #1.7 (025T)
Week 3	2 per	Inspecting switches and relays	Static tests with the Ohm meter : a) Explanation of the Ohm meter b) Measuring resistance c) SPST, DPDT, SPDT, DPDT switches d) Circuit-breakers and fuses e) SPST, SPDT relays The inspection will determine whether the component is functioning	Laboratory Preparation: Read the corresponding laboratory activity text Laboratory Reports: Record the measurements taken and compare them with the theoretical values. Comment on the results.	#2.2 (025T) #2.4 (025T)
Week 4	2 per	Electrical load analysis of a DC system on a single engine airplane	Directed activity: Students are divided into two teams and under the instructor's supervision, achieve static load analysis on two aircraft.	Laboratory Preparation: Read text corresponding to CAR 551.200 and Standards AC43-13 Prepare the load balance. Laboratory Reports: Record the activities and measurements taken and compare them with the theoretical values. Comment on the results.	#5.7.1 (025T) #5.7.2 (025T)
Week 5	2 per	Presentation and use of the simulator (Familiarisation with)	A practical presentation of how to use the DC simulator (FR601-M) by the instructor (40 min.) Students will use the simulator as operators (60 min) to start various systems.	Laboratory Preparation: Read the corresponding laboratory activity text Laboratory Reports: Complete the procedures taken. Comment on the results.	#1.12 (025T) #1.14 (025T)
Week 6	2 per	Using the wiring diagram in order to use the voltmeter and Ohm meter.	- Identifying elements on the diagram - Identifying elements on the simulator - Measuring voltage and resistance on the different elements of the DC simulator (FR601-M). - Troubleshooting (open circuit type failure) a) troubleshooting exclusively with the Ohm meter, b)	Laboratory Preparation: Read the corresponding laboratory activity text Laboratory Reports: Record the measurements taken and compare them with the theoretical values. Comment on the results.	#1.17 (025T) #1.18 (025T)

			troubleshooting exclusively with the voltmeter		
Week 7	2 per	Troubleshooting systems Finding defects	Troubleshooting FR601-M DC single engine simulator using the voltmeter or the Ohm meter in compliance with the *Manuel de procédures monomoteur à pistons 14 V* (executing a test procedure). Failures will be of the open-circuit type. Systems studied: - Anti-collision - Navigation lights - Landing lights **- Fuel level**	Laboratory Preparation: Read the corresponding laboratory activity text Laboratory Reports: Record the measurements taken and compare them with the theoretical values. Comment on the results.	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)

Periods		Content		Personal Study	Objectives
Week 8	2 per	Troubleshooting systems Finding defects	Using *Manuel de procédures monomoteur à pistons 14v*. to simulate the *context* of the individual exam. Open-circuit type failure Systems studied: - Anti-collision - Navigation lights - Landing lights - Fuel level - Fire detection system	Laboratory Preparation: Read the corresponding laboratory activity text Laboratory Reports: Record the measurements taken and compare them with the theoretical values. Comment on the results.	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)
Week 9	2 per	Troubleshooting Exam	Individually, using *Manuel de procédures monomoteur à pistons 14V* students will find on the DC datasheet (FR601-M) the system defect chosen by the instructor. Open-circuit type failure Systems on the exam : - Anti-collision - Navigation lights - Landing lights - Fuel level		#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)
Week 10	2 per	Inspecting aircraft components	In the hangar on a single-engine piston aircraft: Check operation of these elements to detect defects in the systems: -Anti-collision lights -Navigation lights - Landing lights -GPU - Fuel levels	Laboratory Preparation: Study the systems diagrams discussed in class which are in the indicated aircraft manuals. Laboratory Reports: Record the condition of the inspected systems.	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)
Week 11	2 per	Inspecting the DC power generation system on an aircraft.	In the hangar : Check the operation of the power generation system on a running single engine piston aircraft (run-up).		#3.3 (025T)
Week 12	2 per	Inspecting power generation and starting system components on an aircraft	In the hangar on a single-engine turbine : Demonstration and inspection : Review inspection procedures for the operation of components to detect defects in the power generation or starting system. l	Laboratory Preparation: Read the corresponding texts in the Course Notes and the Reference Manual Laboratory Reports: Record the activities and measurements taken	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)
Week 13	2 per	Demonstration on the maintenance of lead-acid batteries and Troubleshooting exercises	Students will be divided into two groups in the laboratory. Rotation: 1st group (1 period) : - Demonstration by the technician on the maintenance of lead-acid batteries 2nd group (1 period) : - Troubleshooting exercise using the DC simulator (FR601-M) (starting and generation).	Laboratory Preparation: Read the corresponding texts in the Course Notes and the Reference Manual Laboratory Reports: Record activities and measurements taken and compare them with the theoretical values. Comment on the results.	#5.1 (025T) #5.2 (025T) #5.3 (025T) #5.4 (025T)
Week 14	2 per	Demonstration on the maintenance of Nickel-Cadmium batteries	Students will be divided into two groups in the laboratory. Rotation : 1st group (1 period) : - Demonstration by the technician on the maintenance of Nickel-	Laboratory Preparation: Read the corresponding texts in the Course Notes and the Reference Manual Laboratory Reports: Record activities and measurements taken and compare them with the	#1.1 (0263) #1.2 (0263) #1.3 (0263)

		and Troubleshooting exercises	Cadmium batteries 2nd group (1 period) : - Troubleshooting exercise using the DC simulator (FR601-M) (starting and generation).	theoretical values. Comment on the results.	

Periods		Content		Personal Study	Objectives
Week 15	2 per	Exam on power generation or starter circuit troubleshooting	Individually, students will use the *Manuel de procédures monomoteur à pistons 14v,* to find system defects slected by the instructor (starting or power generation) on the DC simulator (FR601-M)		

SYNTHESIS OF SUMMATIVE EVALUATION METHODS

Theory

Description of Evaluation Activity	Context	Learning Objective(s)	Due Date (date assignment is due or exam given)	Weighting (%)
Problems	Personal Work	All	Weekly	10%
Test 1	Time: 2 periods Individual sheet of notes (letter format, double-sided, handwritten)	#1.1 to #1.16 (025T)	Week 7	20%
FINAL EXAM FOR THE COURSE	Time: 2 periods Individual sheet of notes (letter format, double-sided, handwritten)	All	Week 15	30%

Sub-total : 60%

Practical Work

Description of Evaluation Activity	Context	Learning Objective(s)	Due Date (date assignment is due or exam given)	Weighting (%)
2. Dischargers and bonding braids	Laboratory Work : Individual evaluation of laboratory work (75%) : Measurements, handling, interpreting information Report evaluation (25%) INDIVIDUAL REPORT	#1.6 (025T) #1.7 (025T)	Following week	3%
3. Inspection of switches and relays		#2.2 (025T) #2.4 (025T)	Following week	3%
4. Achieving load balance of a DC system on a single-engine airplane		#5.7.1 (025T) #5.7.2 (025T)	Following week	3%
5. Presentation and use of DC single engine simulator (Familiarization with)		#1.12 (025T) #1.14 (025T)	Following week	3%
6. Using wiring diagrams to use the voltmeter and Ohm meter		#1.17(025T) #1.18 (025T)	Following week	3%
7. Troubleshooting systems		#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)		(Formative)
8. Troubleshooting systems		#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)		(Formative)
9. Troubleshooting Exam	ÉVALUATION 1 (Individual)	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)	Current week	6%
10. Inspection of components on an aircraft	Laboratory Work : Individual evaluation of laboratory work (75%) : Measurements, handling, interpreting information Report evaluation (25%)	#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)	Week 11	3%

11. Inspect DC generating system on an aircraft.	Laboratory Work: Individual evaluation of laboratory work (75%) : Measurements, handling, interpreting information. Report Evaluation (25%) INDIVIDUAL REPORT	#3.3 (025T)	Week 13	3%
12. Inspect elements of the power generation and starter systems on an aircraft.		#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)	Week 13	3%
13. Demonstrate maintenance of Nickel-Cadmium batteries		#5.1 (025T) #5.2 (025T) #5.3 (025T) #5.4 (025T) #1.1 (0263) #1.2 (0263) #1.3 (0263)	Week 15	3%
14. Troubleshooting exercises		#1.18 (025T) #2.5 (025T) #3.3 (025T) #3.4 (025T) #3.5 (025T)		(Formative)
15. Exam on troubleshooting power generation circuit or starter circuit	ÉVALUATION 2 (Individual)	#1.1 (0263) #1.2 (0263) #1.3 (0263) #1.1 (0263)	Current Week	7%

Sub-total : 40%

TOTAL : **100%**

Note:
Students who are absent from a laboratory session (without valid justification) cannot be fully or partially evaluated for activities associated with this manipulation. See the department rules on the ÉNA website.

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

A passing mark is 60%.

(2) Course Attendance

Students must be present for summative evaluations.

(3) Submitting Assignments

Assignments must be submitted by the date, place and time determined by the instructor Any assignment submitted after the due date will be penalized 10% per day for each work day it is late. On the sixth day after the due date, the assignment will receive a zero (0).

(4) Presentation of Written Work

Students must follow the standards adopted by the College for written work (*Normes de présentation matérielle des travaux écrits*). These can be found in the documentation centre on the College web site (http://ww2.college-em.qc.ca/biblio/normes.pdf) under the heading ***Aides à la recherché.***

CLASS PARTICIPATION EXPECTATIONS

Laboratory safety and use of the premises :

Students must be under the supervision of an instructor or a technician whenever they are in the laboratory or using the equipment, unless otherwise indicated.

Any student whose conduct in the laboratory poses a risk to others will receive a warning from the instructor and then be excluded from the laboratory until the case can be reviewed by the instructor and the coordinator of the Avionics Department.

REQUIRED MATERIAL

All material required for this course is provided by the college. Students must bring the required texts listed below to the theory and laboratory classes.

MEDIAGRAPHY

Required Text

- EISMIN, THOMAS K. – Aircraft Electricity & Electronics, Fifth Edition, Glencoe, 2002.
- Laboratory Notebook (COOP).

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled at Collège Édouard-Montpetit must become familiar with and comply with the institutional policies and regulations. In particular, these policies address learning evaluations, maintaining admission status, French language policies, maintaining a violence-free and harassment-free environment, and procedures regarding student complaints. The French titles for the policies are:

Politique institutionnelle d'évaluation des apprentissages, les conditions particulières concernant le maintien de l'admission d'un étudiant, la Politique de valorisation de la langue française, la Politique pour un milieu d'études et de travail exempt de harcèlement et de violence, les procédures et règles concernant le traitement des plaintes étudiantes.

The full text of these policies and regulations is accessible on the College web site at the following address: www.college-em.qc.ca. If there is a disparity between shortened versions of the text and the full text, the full text will be applied and will be considered the official version for legal purposes.

OTHER DEPARTMENTAL REGULATIONS

Students are encouraged to consult the website for the specific regulations for this course:
http://www.college-em.qc.ca/
www.college-em.qc