

280-4C5-EM WINTER 2014 Pre-Flight

COURSE OUTLINE

COURSE:	Aircraft Instrume	ntation	
PROGRAM:	280.C0 Aircraft Maintenar	nce Technology	
DISCIPLINE :	280 Aeronautics		
WEIGHTING:	Theory: 3	Practical Work: 2	Personal Study: 2

Instructor(s)	Office	Extension	🖂 e-mail or web site
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OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinator(s)	Office	extension	⊠ e-mail or website
Ménard Pierre	C-160	4207	pierre.menard@cegepmontpetit.ca
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CONTEXT OF THIS COURSE IN THE PROGRAM

This course is offered during the fourth session of the program. It is intended for future Category M Aircraft Maintenance Engineers (AME). The objective is to enable them to diagnose and determine appropriate maintenance intervention for various aircraft instruments. In order to do this, they must know the terminology, their roles and operating principles. They must also be able to interpret the technical documentation provided by aircraft manufacturers.

This course presents a fairly complete overview of all types of instruments found onboard an aircraft.

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.

Transport Canada

This course outline meets the requirements of Training Organisation Certification Manual (MCF) of Transport Canada.

The Department applies Transport Canada standard which allows a maximum absence of 5% for the course (theory and laboratory). The department compiles absences of all students enrolled in Aircraft Maintenance (280.C0) and Avionics (280.D0) according to Transport Canada requirements. The application of Transport Canada policies regarding absences is available on the college website and in the student agenda under the heading « Privilèges accordés par Transports Canada ».

MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

- **0263** Verify the operation of simple alternating-current circuits on an aircraft.
- **0265** Verify communications, navigation and instrumentation systems.

TEACHING AND LEARNING STRATEGIES

Theory: Formal lectures, audio-visual support, short video and the use of a flight simulator.

Laboratory: See page 5.

I	Learning Objective	Content	Personal Study Activites	No. of hours
1.1	Distinguish and describe the elements and characteristics common to the instruments.	 Presentation of the Course Outline The elements of an instrument The characteristics of an instrument Types of errors TC Appendix C, part 2, 22.4.1, 22.4.2, 22.4.16 		3
1.2	Describe different methods of trans- mitting and displaying information.	 Electro-mechanical and mechanical indicators Liquid crystal alphanumeric or electroluminescent diode indicators Cathode ray tubes (CRTs) and liquid crystal screens Synchro transmitters Digital transmission line (digital ARINC Bus) 	otes.	3
1.3 1.4	Describe the role and operation of atmos- pheric reference instruments. Recognize the requirements for maintaining navigability.	 Atmosphere and atmosphere type Pitot and static circuits Altimeter Vertical speed indicator Pressurization control instruments Anemometer, machmeter, excessive speed warning Aerodynamic data computer Applicable airworthiness standards Inspection, common maintenance, precautions 	Read course notes and personal notes. • Quiz	3
1.5	Describe the operation and role of basic magnetic and gyroscopic instruments.	 Magnetic compass Characteristics and properties of a gyroscope Gyroscope training Turn and side slope indicator and turn coordinator Artificial horizon Gyroscopic compass Erector systems Gyromagnetic compass Introduction to the inertial navigation system Gyrolaser Applicable airworthiness standards Inspection, common maintenance, precautions 	Reac	3
	Exam 1			3
1.6	Describe the role and operation of engine control and aircraft system instruments.	 Temperature measurement Pressure measurement Quantity guages Tachometers Synchroscope Flowmeter Torquemeter Engine pressure ratio Vibration measurement Angle of attack measurement Stall protection system 	 Read course notes and personal notes. 	7

L	earning Objective	Content	Personal Study Activites	No. of hours
1.7	Describe the role, architecture and operation of a centralized failure management system.	 An example of architecture EICAS (Engine indicating & crew alerting system) or ECAM (Electronic centralized aircraft monitoring) Maintenance diagnostic system 	Read course notes and personal notes.	5
	Exam 2			3
1.8	Describe the role and operation of navigation instruments.	 ADF VOR DME ILS Radio altimeter INS GPS ATC transponder Collision avoidance system (TCAS) Ground proximity warning system (GPWS) Weather radar 	Read course notes and personal notes.	8
1.9	Describe the operation of the autopilot and flight director systems.	 Architecture of an autopilot system Basic and higher functions Auto-throttle Flight director 	Read course notes and personal notes.	2
1.10	Describe the role and operation of the flight management system.	 Introduction to flight management system (FMS) 	Read course notes and personal notes.	1
1.11	Describe the role and operation of the flight recorders.	 Flight data acquisition recording system (FDARS) Flight data acquisition unit (FDAU) Flight data recorder (FDR) Quick access recorder (QAR) Cockpit voice recorder (CVR) 	Read course notes and personal notes.	1
	Exam 3			3

SYNTHESIS OF SUMMATIVE EVALUATION METHODS

<u>THEORY</u>

Description of evaluation activity	Context	Learning objective(s)	Due date (approximate date assignment due or exam given)	Weighting (%)
Multiple choice and short answer exam	Individual	1.1 to 1.5	Week 5	20%
Multiple choice and short answer exam	Individual	1.6 to 1.7	Week 10	20%
Multiple choice and short answer exam	Individual	1.8 to 1.11	Week 15	20%

Sub-total : 60%

LABORATORY

Teaching and learning strategies

Students will perform various inspection activities of onboard instruments in teams of two.

- Weeks 1, 2, 3, the teacher will demonstrate various test benches in the instruments laboratory.
- The following weeks the students perform each activity in teams of two.
- The exercises are performed using the manuals available in the laboratory.
- The laboratory manuals may include:
 - excerpts from CAR standards
 - excerpts from aircraft maintenance manuals
 - manuals of components
 - procedural manuals for use of test equipment
- For each exercise, students will need to complete the data sheets included in the laboratory course notes.
- The information students record in their course notes will serve as a study guide for the two exams.

COURSE PLAN – PRACTICAL WORK (LABORATORY)

Activity Period: Weeks 1, 2, 3

	Learning Objective	Content	Personal Study Activities	No. of hours
1.1	Learn the concepts and principles of	 Presentation of course outline. 	 Prior reading of the 	
	operation of instruments and equipment test laboratory.	 Demonstration of various test benches. 	lab.	
1.2	Performing the work in accordance with safety rules and operating procedures of the laboratory	 Descriptions of tests to be carried out during the course. Procedures and precautions. 		8
	equipment.			

	Learning Objective	Content	Personal Study Activities	#hours
2.0	Perform checks on pitot-static circuits.	 Excerpts of CAR standards. Leak test (CAR 571), calibration test (CAR 605/625). 	Reading.Complete data	
2.1	Identify compliance standards and appropriate procedures.	 Excerpts from aircraft maintenance manuals (where applicable). Components manuals. 	sheets.	
2.2	Use appropriate testing equipment.	 Procedures of manufacturer's test bench. 		
2.3	Compare data obtained for each check in order to comply with CAR and manufacturer's standards.	 Calibrating test equipment. Frequency of performing tests. Test points to simulate. Tolerances. 		2
2.4	Meticulously record the results of the checks that were carried out.	 Description of testing equipment: components and operation principle. Description of pitot-static circuit: components and operation principle. 		

Activity Periods: Weeks 4 to 7 and 9 to 12

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	Learning Objective	Content	Personal Study Activities	# hours
3.0	Perform checks on the altimeter.	 CAR standards. 	 Reading. 	
3.1	Identify compliance standards and appropirate procedures.	 Components manuals. Manufacturer's test bench procedure. Calibrating test equipment. 	 Complete data sheets. 	
3.2	Use appropriate testing equipment.	 Frequency of performing tests. 		
3.3	Compare data obtained for each check in order to comply with the manufacturer and CAR's standards.	 Test points to simulate. Tolerances. Scale error, hysteresis error, persistence, friction error, case sealing, barometric 		2
3.4	Meticulously record the results of the checks that were carried out.	 scale error. Description of testing equipment; digital barometer, vacuum chamber, vacuum pump. Description of barometric altimeter; ID plate, components, operation. 		

Activity Periods: Weeks 4 to 7 and 9 to 12

	Learning Objective	Content	Personal Study Activities	# hours
4.1 4.2 4.3	Perform checks on turn and bank indicator. Identify compliance standards and appropriate procedures. Use appropriate testing equipment. Compare data obtained for each check in order to comply with the manufac- turer and CAR's standards. Meticulously record the results of the	 Manufacturer's specifications Calibrating test equipment Tests: check inclinometer, needle Tolerances Description of testing equipment-: power source, turntable, strobe light Description of turn and side slope turn indicator : ID plate, components, operation 	 Reading. Complete data sheets. 	2

Activity Period: Week 8

Learning Objective	Content	Personal Study Activities	# hours
Exam 1			2

Activity Periods: Weeks 4 to 7 and 9 to 12

	Learning Objective		Content		Personal Study Activities	# hours
5.0	Perform checks on a directional gyro	-	Manufacturer's specifications.	-	Reading.	
5.1	Identify compliance standards and appropriate procedures.	•	Calibration of test equipment. Tests: free rotation of the rotor, rotor speed, drift, erector mechanism,	•	Complete data sheets.	
5.2	Use appropriate testing equipment		locking mechanism, starting the rotor,			
5.3	Compare the data for each check to to comply with CAR and the manufacturer's standards.	•	housing seal, flow. Tolerances. Description of the testing equipment: pneumatic power source, Scorsby			2
5.4	Meticulously record results from the checks performed.	-	table. Description of the directional indicator: ID plate, components, operation.			

Activity Periods: Weeks 4 to 7 and 9 to 12

		Learning Objective	Content	Personal Study Activities	# hours
	6.0	Perform checks on a tachometer.	 CAR standards. 	 Reading. 	
	6.1	Identify compliance standards and appropriate procedures.	Test bench specification.Calibration of test equipment.Tolerances.	 Complete data sheets. 	
	6.2	Use appropriate testing equipment.	 Tests to run-: scale error, friction 		
	6.3	Compare the data for each check to ensure compliance with the standards of the manufacturer's builders and CARs.	 error, hysteresis error. Description of the test equipment-: components, operation. Description of the tachometer-: 		2
	6.4	Meticulously record the results of the checks performed.	components, operation.		

Activity Periods: Weeks 4 to 7 and 9 to 12

	Learning Objective	Content	Personal Study Activities	# hours
7.0	Perform tests on a manometer	 Test bench specification. 	 Reading. 	
7.1	Identify compliance standards and appropriate procedures.	 Calibration of test equipment. Tolerances. Tests to run: scale error, friction 	 Complete data sheets. 	
7.2	Use appropriate testing equipment.	error, hysteresis error.		
7.3	Compare the data for each test to ensure compliance with the standards of manufacturers, builders and CARs.	 Description of the test equipment-: components, operation. Description of the tachometer-: components, operation. 		2
7.4	Meticulously record the results of the checks performed.			

	Learning Objective	Content	Personal Study Activities	# hours
8.0	Perform tests with the magnetic compass.	 Running procedure 	 Reading. Complete data 	
8.1	Identify compliance standards and appropriate procedures.	 Calibration of test equipment. Run frequency, test points to simulate, tolerances. 	 Complete data sheets. 	
8.2	Use appropriate testing equipment.	 Tests to run: liquid,compensation 		2
8.3	Compare the data for each test to ensure compliance with the standards of manufacturers, builders and CARS.	 mechanism, friction, magnet neutralisation, compensation chart. Description of the master compass : components, operation. 		
8.4	Meticulously record the results of the checks performed.	 Description of the magnetic compass : components, operation. 		

Activity Periods: Weeks 4 to 7 and 9 to 12

Activity Period: Weeks 13 and 14

	Learning Objective	Content	Personal Study Activities	# hours
9.0	Troubleshooting connected to the pitot- static system on an aircraft.	Aircraft maintenance manuals.Manufacturer's parts manuals.	 Reading. 	
9.1	Perform system testing of protection against the frost of pitot-static circuits.	 Locations of components on available aircraft. Checklists. 		4
9.2	Check for leaks in the pitot-static system of the King Air.	 Precautions. 		

Activity Period: Week 15

Learning Objective	Content	Personal Study Activities	# hours
Exam 2			2

SYNTHESIS OF SUMMATIVE EVALUATION METHODS

Practical Part

Evaluation Activity	Context	Learning Objective	Evaluation Period	Weighting %
Exam 1.	Essay exam. Individual.	First 3 exercises.	Week 7	15%
Exam 2.	Essay exam. Individual.	Last 4 exercises.	Week 15	15%
Evaluation of the semester.	Teacher evaluation.	See evaluation chart	After week 3, excluding Exam1 and Exam 2	10%

Sub-total : 40%

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REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

The passing mark for this course is 60%.

(2) Attendance for Summative Evaluations

Students must be present for summative evaluations.

(3) Submitting Assignments

All assignments must be submitted by the date, hour and location designated by the instructor(s). Late assignments will be penalized in the following manner:

(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://www.cegepmontpetit.ca/biblio under the heading « **Aide** ».

REQUIRED MATERIAL

Course Notes.

MEDIAGRAPHY

ASH Georges et collaborateurs, <u>Les capteurs en instrumentation industrielle</u>, Éditeur Dunod, 1983. 620.0044 A 812 C 1983

Aviation Technician Training Series, Avionics Fundamentals, Éditeur I.A.P. 1987.

CHAPPUY J.P. : Grégori J.P. Instruments de bord, Éditeur Paris, Institut Aéronautique Jean Mermoz, 1978. 629.135 C 4671 1978

Tome 1 : mesure de vitesse, incidence, température, dispositifs de sécurité, compas de navigation, contrôle moteurs.

Tome 2 : équipements électroniques.

Tome 3 : instruments gyroscopiques, altimètre, variomètre, compas magnétique.

CRANE Dale, <u>Aircraft Instruments Systems</u>, Éditeur Aviation Maintenance Publishers Inc. 629.135 C 891a

Orford Air Training School, Navigation aérienne, Les aides radio, Éditeur Modulo. P 629.1351 098 r 4Fq

Oxford Air Training School, <u>Navigation aérienne</u>, <u>Instruments de bord</u>, Québec, Ministère de l'éducation, SGME 1981. 629.1352 098 i Fq.

PALLETT EHJ, Automatic Flight Control, Éditeur Granada, Toronto, 1983. 629.1352 p 166 1983

PALLETT EHJ, <u>Aircraft Instruments</u>, Éditeur Pitman Publishing Limited, 629.135 p 1662 Édition 1972-79, 629.135 p 1662 Édition 1981.

PALLETT EHJ, <u>Aircraft Instruments and Integrated System</u>, édition Longman Scientific & Technical, 1992.629.135 P 166 ai

POWELL J, Aircraft Radio Systems, Éditeur Pitman Publishing Limited, 1981. 629.135 p 8843

R. Galan, <u>Avionique 2002</u>, Éditeur : Institut Aéronautique Jean Mermoz, 1993 629.1355G146

Transports Canada, Règlement de l'aviation canadien (RAC 523, 525, 571, 605-625

Jeppesen, <u>Avionics Fundamentals</u>. Éditeur : Sanderson Training Products. 629.135A958

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled at cégep 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: <u>http://www.cegepmontpetit.ca/campus-de-longueuil/le-college/reglements-et-politiques</u>. 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 specific regulations related to this course: <u>http://www.cegepmontpetit.ca/</u> http://ena.cegepmontpetit.ca/etudiants-actuels/programmes-d-etudes/departements-d-enseignement#a2

NOTE: This Course Outline is a translation of the *Plan de cours* for 280-605-EM: *Instrumentation d'aéronefs.* If there is a disparity, then the original French version will be considered the official version for legal purposes.