ÉCOLE NATIONALE D'AÉROTECHNIQUE
Un campus du collège Édouard-Montpetit

# 280-5A4-EM
## FALL 2013
## Pre-Flight

# COURSE OUTLINE

**COURSE:** **Aircraft Systems Operation**

**PROGRAM:** 280.C0 Aircraft Maintenance Technology

**DISCIPLINE:** 280 Aeronautics

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

| Instructor(s) | Office | ☎ Extension | ✉ Email or Website |
|---|---|---|---|
| Vincent Grenon | C-186 | 4623 | vincent.grenon@college-em.qc.ca |

**OFFICE HOURS**

| | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY |
|---|---|---|---|---|---|
| Morning | | | | | |
| Afternoon | | | | | |

| Coordinator(s) | Office | ☎ Extension | ✉ Email or Website |
|---|---|---|---|
| Pierre Ménard | C-160 | 4207 | pierre.menard@college-em.qc.ca |
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## CONTEXT OF THIS COURSE IN THE PROGRAM

The course *Aircraft Systems Operation* (280-5A4) is offered during the 5th session of the Aircraft Maintenance Program (280.C0). All students enrolled in this program are called upon in one manner or another to analyze, do work and inspect the integrity and operation of aircraft systems.

In the workshops, students review the condition of components and check their operation on the test benches. On the aircraft, they perform necessary maintenance work on the systems to assure the airworthiness of the aircraft. Troubleshooting is characterized by first analyzing, understanding and testing the operation of the systems. Next the reasons for the system failure must be identified, justified and confirmed. In order to correct the problem, students need to then be able to replace the defective component, check the settings and make the adjustments as determined by the designer of the aircraft and approved by the civil aviation authority. Students must find this information in the appropriate maintenance manuals. The final step involves checking the integrity of the system by testing its operation and then signing the maintenance release, in the appropriate technical files.

In short, to carry out all of the responsibilities related to the position, an aircraft maintenance technician must be able to explain and analyze the operation of systems as well as their components, use appropriate vocabulary, gather the necessary documentation for the job and apply all required security measures to maintain the airworthiness of the 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 ».

## MINISTRY OBJECTIVES

- Explain the operation of aircraft systems.
- Perform activities related to maintaining aircraft systems (026C).
- Perform the maintenance of landing gear (026).

## TEACHING STRATEGY

The course is structured using formal lectures and computer projections. Demonstrations using parts that are available in the room enhance the theoretical explanations. The physical principles used in the operation of the systems will be explained during these periods, supported by questions and discussions to develop a detailed analysis of the operation of the systems.

# COURSE PLAN

**ATA CHAPTER 32** **16 class periods**

This chapter explains the operation of the landing gear systems.

**Learning Objectives**

1- Become familiar with the course outline.

2- Describe the various types of landing gear.

3- Explain the role and operation of each component of the landing gear.

4- Determine the order and the logical link between the various components of a landing gear.

5- Determine various back-up methods used to operate landing gear and locking indications.

6- Analyze the general operation of a landing gear system.

7- Explain the normal and emergency retraction and extension operation of the system.

8- Explain the operation of the braking systems in normal, automatic and emergency mode.

**Content**

1- Fixed and retractable landing gear; characteristics and configurations of landing gear.

2- Struts, actuators, valves and sequence valves, hydraulic fuses, relief valves, inspection panels, locking mechanisms, shock absorbers, indications, electrical contactors, brakes, valves, antiskid valves, servo valve, antiskid control box, wheel speed sensors, distributors, braking mode, wheel orientation.

3- Control action and location of the different controls used to operate landing gear.

4- Various power sources used to operate landing gear braking system.

5- Examples of operation systems on various aircraft.

6- Failure simulation and analysis of possible causes.

7- List of safety measures.

## ATA CHAPTER 26 — 2 class periods

This chapter explains the operation of fire protection systems.

### Learning Objectives

1- Classify different types of fire.
2- Locate the different areas where there is a greater risk of overheating or fire.
3- Explain the operation principle of different types of sensors (overheating, fire, smoke).
4- Describe different types of fire extinguishers.
5- Analyse the operation of electrical systems for detection, extinguishing and alarm.
6- Analyse the operation of different fire prevention systems.
7- Determine the various actions to take during a fire.

### Content

1- Different classes of fires.
2- Different causes of overheating or fire: hot air leaks, sparks, hydrocarbon volatility, overheated brakes and electrical problems.
3- Different controlled areas: engines, landing gear well, APU compartment, various cargo and hot air systems.
4- Different types of sensors: bimetal, thermocouple, continuous elements, pneumatic.
5- Smoke detectors: ionisation, photoelectric cell.
6- Fire extinguishers and extinguishing agents.
7- Extinguishing and alarm systems.
8- Procedure in case of fire.

## ATA CHAPTER 36 — 3 class periods

This chapter explains the operation of pneumatic systems on board an aircraft.

### Learning Objectives

1- Identify various sources that can provide an aircraft with pneumatic energy.
2- Explain the purpose of the pneumatic system on an aircraft.
3- Describe all the elements of a pneumatic distribution system.
4- Explain the role and operation of each component of the pneumatic system.
5- Identify various controls used to operate a pneumatic system.
6- Interpret the various indications related to the pneumatic system.

### Content

1- Power sources: engine, APU, GPU, external cylinders.
2- Compressors, bleed valves, pressure and flow regulation valves, heat exchange, protection elements against overheating, various electric or electro-pneumatic valves and filters.
3- Mechanical controls and electro-pneumatic controls.
4- Different user systems of a pneumatic system: starting, air conditioning, pressurization, anti-icing and reverse thrust systems.

## ATA CHAPTER 30 — 3 class periods

This chapter explains the operation of the systems for controlling the formation of frost and rain.

### Learning Objectives

1- Identify different types of frost/ice.
2- Identify the conditions that favor the formation of frost and the resulting dangers.
3- Interpret information available on the dashboard.
4- Identify the areas that are protected against the formation of frost and the elimination of ice.
5- Identify elements that protect against overheating in an anti-icing system.
6- Explain the operation of different types of frost sensors.
7- Describe types of de-icing and anti-icing systems on aircraft.
8- Explain the role and operation of de-icing and anti-icing systems.
9- Explain the operation of a windshield washer and rain repellant systems.
10- Explain the operation of a wiper.

### Content

1- Various ways to prevent and eliminate icing: electric, pneumatic and liquid.
2- Study of types of circuits.
3- Nose cowl anti-icing system of jet and turbo prop engines.
4- Propeller blades protection circuit.
5- Leading edges protection circuit.
6- Protection circuit for windshields, Pitot tubes, temperature sensors and external drains.
7- Finding the necessary documentation for testing and checking an anti-icing protection system.
8- Applying safety instructions during interventions on the de-icing or anti-icing system.

## ATA CHAPTER 21 — 10 class periods

This chapter explains the operation of aircraft air conditioning and pressurization systems.

### Learning Objectives

1- Define the objectives of cooling, air conditioning, ventilation and pressurization.
2- Describe the elements that make up an air conditioning system on a jet or turbo prop engine powered aircraft.
3- Explain the role and operation of a cooling system.
4- Explain the role and operation of each element of a pressurization system.
5- Explain the pressure schedule inside the aircraft cabin depending on the flight altitude.
6- Interpret information from the dashboard.
7- Implement safety procedures when working on an air conditioning and pressurization system.

### Content

1- Introduction to the effects of pressure change on human abilities.
2- Definition of comfort conditions related to crew and passenger activities.
3- Air treatment in terms of temperature, cleanliness, humidity and pressure.
4- Various means used for cooling, air conditioning and pressurization of the cabin.
5- Study of various systems used on aircraft.
6- Study of various controls, alarms and protection systems.

## ATA CHAPTER 35 — 4 class periods

This chapter explains the operation of oxygen systems on board an aircraft.

### Learning Objectives

1- Define the different situations that require the use of an oxygen supply.
2- Identify the different sources used to supply oxygen.
3- Compare the advantages and disadvantages of different sources of oxygen that are used.
4- Explain the role and the operation of each element that make up an oxygen supply system.
5- Implement safety measures that relate to working on an oxygen supply system.

### Content

1- Review of pressure change depending on the altitude.
2- Introduction to the effects a loss of oxygen has on crew members and passengers.
3- Description of various oxygen supply systems.
4- Analysis of the operation and role of each element of an oxygen supply system.
5- Examples of different oxygen supply systems on several aircraft.
6- Introduction to the dangers related to handling and providing maintenance on oxygen supply systems.
7- Implementing safety measures when working on oxygen systems.

## ATA CHAPTER 28 — 10 class periods

This chapter explains the operation of aircraft fuel systems.

### Learning Objectives

1- Identify different types of fuel used in aviation.
2- Define and describe the different functions that a fuel system must ensure.
3- Determine the causes that can lead to fuel contamination.
4- Describe the composition of a fuel system.
5- Explain the role and operation of each element that makes up a fuel system.
6- Locate the components of a fuel system in various parts of an aircraft.
7- Identify the controls and instruments for a fuel system.
8- Describe the precautions and security measures to take during maintenance or when checking a fuel system.

### Content

1- Different types of fuel systems used in aviation.
2- Different methods of engine fuel feeding.
3- Comparison of various fuel systems used on aircraft.
4- Operational analysis of various fuel supply systems.
5- Introduction to various dangers related to the maintenance and upkeep of a fuel system.

**ATA CHAPTER 38** **2 class periods**

This chapter explains the operation of aircraft water and waste systems.

**Learning Objectives**

1- Identify the means used to store and distribute drinking water on board an aircraft.
2- Describe the composition and operation of a drinking water system.
3- Describe the composition and operation of a waste system.
4- Describe the dangers related to the maintenance and upkeep of systems for drinking and waste water.
5- Implement safety measures to take during maintenance or when checking systems for drinking and waste water.

**Content**

1- Study of a drinking water system on a wide-bodied aircraft.
2- Study of waste system used on a wide-bodied aircraft.
3- Introduction to the dangers related to the maintenance and upkeep of systems for drinking and waste water.

**ATA CHAPTER 25** **2 class periods**

This chapter explains the operation of flotation and rapid evacuation systems.

**Learning Objectives**

1- Identify the methods used for rapid evacuation.
2- Explain the locking and unlocking mechanisms operation of the emergency exits.
3- Explain the deployment and inflation of the operation of evacuation slides.
4- Explain the announcement and instruction system operation during a rapid evacuation. -
5- Locate the various components intended for an emergency situation. -

**Content**

1- Introduction to examples of a rapid evacuation. -
2- Describing examples of opening and closing the emergency exits. -
3- Describing examples of inflating evacuation ramps. -
4- Study of the lighting system and rapid evacuation. -
5- Introduction to the dangers related to the maintenance and upkeep of the emergency devices. -

**Personal Learning Activities**

On a weekly basis, students must:

- Review course notes and personal notes.
- Read the specific chapter in one of the suggested books in the Mediagraphy.
- Analyze the operation of the systems and components.
- Take advantage of the hours available for further explanations.

## SYNTHESIS OF SUMMATIVE EVALUATION METHODS

| Description of Evaluation Activity | Learning Objective(s) | Context | | Weighting (%) |
|---|---|---|---|---|
| 1st summative evaluation | Content from the first 5 weeks | Exam with short-answer and/or multiple choice answers | Individual exam that lasts approximately 2 periods | 30% |
| 2nd summative evaluation | Content from Weeks 6 to 9 | Exam with short-answer and/or multiple choice answers | Individual exam that lasts approximately 2 periods | 30% |
| 3rd summative evaluation | Content from Weeks 10 to 15 | Exam with short-answer and/or multiple choice answers | Individual exam that lasts approximately 2 periods | 40% |

**Total: 100%**

# REQUIREMENTS TO PASS THE COURSE

### 1) Passing Mark

The passing mark for this course is 60%.

### 2) Attendance for Summative Evaluations

Attendance for summative evaluation activities is mandatory. Students must meet the requirements to carry out evaluation activities according to the instructor's specification and written in the course outline.

Teachers may refuse to admit students who arrive late without an acceptable justification to a summative evaluation activity.

Absences that are due to serious circumstances (illness, death in the family, major event, etc.) for a summative evaluation activity may receive a zero (0) for the activity.

It is the student's responsibility to make arrangements with the instructor before an evaluation activity or immediately after an absence from ENA to explain the reasons for the absence and to show the appropriate documents. If the instructor determines that the absence was due to a serious and legitimate situation, the student and teacher will make an appropriate arrangement.

### 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 day it is late up to a week. After one week, the assignment will receive a zero (0).

### 4) Presentation of Written Work

The instructor will provide students with information and guidelines regarding the expectations for work submitted. The correction of any work that is determined to be inacceptable because of a poor presentation will be delayed until the work is properly formatted and submitted. In this case, the penalties for late work will be applied until the work is accepted.

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 to la recherché.***

# REQUIREMENTS FOR CLASS PARTICIPATION

Students are expected to follow the rules taught in class regarding the use of equipment and to comply with safety rules related to the operation of aircraft systems and models. Improper use or an improper attitude is dangerous and will lead to a suspension from class. Wearing open shoes in the laboratory is prohibited. Safety goggles must be worn as required.

# REQUIRED MATERIAL

Course manuals (notes) as suggested by the instructor.

## MEDIAGRAPHY

Cassou, G. « Aérotechnique: cellule, équipements et circuits », Éditeur Institut aéronautique Jean Mermoz, 1975. D 629.13431 C 345 a (hydraulique. Trains. Carburant. Oxygène. Dégivrage. Pressurisation).

Féminier, Didier. « Cellule et systèmes d'aéronefs » Modulo Éditeur, 1982. D 629.13431 F 329 c (hydraulique, trains, carburant, oxygène, dégivrage, pressurisation).

Fleury, J., Weyland, J. « Technologie cellule », Institut aéronautique Jean Mermoz, 1981. D 629.13431 F 618t 629.13431 P 873 c (Hydraulique, Trains, Carburant, Oxygène, Sécurité, Dég. Press).

JAP Inc. « A&P Technician Airframe Test guide », édition 2002, ATP series. 629.134C891aS (Hydraulique. Trains. Carburant. Oxygène. Sécurité. Dégivrage. Pressurisation).

JAP Inc. « A&P Technician Airframe Workbook », édition 2000-2001, ATP series. 629.134353A296 1992 S (Hydraulique. Trains. Carburant. Oxygène. Sécurité. Dégivrage. Pressurisation).

Kroes/Watkins/Delp. « Aircraft Maintenance & Repair », 6e édition, Mac Millan/McGraw-Hill, 1993. A629.1346M158m (Hydraulique. Trains. Carburant. Oxygène. Sécurité. Dégivrage. Pressurisation).

Poujade, A. « Cellule et systèmes », Éditeur Institut aéronautique, Jean Mermoz, 1985. D 629.13431 P 873 c (hydrauliques. Trains. Carburant. Oxygène. Dégivrage. Pressurisation).

Ropoll J.C. « Cellule, circuits », Éditeur École nationale de l'aviation civile, 1984. A 629.13431R592c (Hydraulique. Trains. Oxygène. Dégivrage. Pressurisation).

USA, Dep. of Transportation. « Advisary circular DOT FAA », EA-AC 43.13-1B.

USA, Dep. of Transportation. «Airframe and powerplant; airframe handbook », AC 65-ISA, FAA 1976. D 629.1343 E 83a (Hydraulique. Trains. Carburant. Oxygène. Sécurité. Dégivrage. Pressurisation).

USA, Dep. of Transportation. « Maintenance d'aéronefs, Méthodes, techniques et pratiques reconnues » Circulaire d'information, EA-AC 43.13-1A et 2A ISBN2-89113-114-2.

## 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: http://www.college-em.qc.ca/campus-de-longueuil/le-college/reglements-et-politiques. 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:
http://ena.college-em.qc.ca/etudiants-actuels/programmes-d-etudes/departements-d-enseignement#a2

### 1. Course Attendance

It is the student's responsibility to attend all classes and participate actively.

As soon as a student has missed 10% of the hours of the practical part of the course, the student will receive a warning message regarding the absences; when the student has missed over 20% of the hours of the practical part of the course, the student will receive a warning that he or she is excluded from the course.

The penalty for excessive absence is a mark for the points accumulated at the point of exclusion or 55% if the accumulated points exceed 60% when the penalty goes into effect.

An absence that is excused for serious reasons that cannot be made up will not receive a penalty. Students who believe they have received an unfair penalty can appeal to the appropriate member of the department.

### 2. Tardiness

Students who arrive more than 10 minutes after the beginning of the first period of the course are considered absent for this period. Students who arrive late to the other periods of the same course will not be admitted.

### 3. Absence of the Instructor

Students must wait ten minutes before considering that a teacher is absent for the course period and must be present for the second hour of the course unless an absence has been announced.

### 4. Safety and Use of Department Rooms and Services

See the Pre-Flight rules on the college website under the heading for rules and policies at ÉNA (*Règles et politiques*): http://ena.college-em.qc.ca/etudiants-actuels/documents-et-consignes/regles-de-securite.

### 5. Mark Revisions

See Article 6.6.2 of the policies regarding evaluations in the *Politique institutionnelle d'évaluation des apprentissages*.

**NOTE: This Course Outline is a translation of the *Plan de cours* for 280-514-EM: *Fonctionnement des systèmes*. If there is a discrepancy, then the original French version will be considered the official version for legal purposes.**