

COURSE OUTLINE

COURSE: Helicopters
PROGRAM: 280.C0 Aircraft Maintenance Technology
DISCIPLINE: 280 Aeronautics
WEIGHTING: Theory: 2 Practical Work: 2 Personal Study: 2

Teacher(s)	Office	☎ Extension	✉ Email or Website
José Marcoux	C-183	4407	jose.marcoux@cegepmontpetit.ca

OFFICE HOURS FOR STUDENTS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					
Other					

Coordinator(s)	Office	☎ Extension	✉ Email
Éric Goudreault	C-160	4691	eric.goudreault@cegepmontpetit.ca
Stéphanie Arpin	C-160	4630	stephanie.arpin@cegepmontpetit.ca

CONTEXT OF THIS COURSE IN THE PROGRAM

This course is offered during the program's fourth semester.

The basic knowledge students acquire in this course is essential for any future work regarding helicopters.

It is also RECOMMENDED that students complete this course before signing up for an internship during the 5th or 6th sessions.

The overall objective of the course is to apply the principles of aerodynamics to flying and maintaining a helicopter.

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.

Transports 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 ».

COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

To master scientific bases and aeronautic maintenance work technics.

MINISTRERIAL OBJECTIVE(S) AND COMPETENCIES

0268 To apply principles of aerodynamics to flight and helicopter maintenance.

TERMINAL OBJECTIVE OF THE COURSE (FINAL COURSE OBJECTIVE)

- To establish links between the principles of aerodynamics and the various components of a helicopter.

TEACHING AND LEARNING STRATEGIES

Theory:

This part of the course includes seven modules covering basic concepts in aeronautics, aerodynamics and helicopters.

This course, each week, will be in synchronous mode with sometimes preparatory readings (documents deposited on LÉA, PowerPoint, YouTube video links of presentations or video to listen or consult), and at certain times quizzes for a validation of learnings, the whole taking place through Office 365 Teams (you must use your Cégep email to connect to it: 1234567@cegepmontpetit.ca)

Practical Work:

The practical part is divided into nine chapters that deal with nomenclature and various mechanical aspects specific to helicopters. For this part of the course, simulation exercises, plenary sessions, demonstrations, identification exercises and handling will be used.

COURSE PLAN

LEARNING OBJECTIVES

1. Establish connections between the principles of aerodynamics and helicopter flight.
2. Establish connections between the principles of aerodynamics and the various helicopter components.
3. Perform activities related to balancing rotors.

THEORY

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	1	BASIC CONCEPTS	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
2	1, 2	STARTING <ul style="list-style-type: none"> ▪ Engines, materials, gyroscopic precession, change in pitch, buffeting, lead and lag, swash plate, anti-torque system, history of the evolution of helicopters ▪ Change in tangential velocity on a rotating blade. ▪ Importance of centrifugal force exerted on a rotating blade. ▪ Construction of a blade and material used. ▪ Shapes and blade quantity. ▪ Air resistance on a rotating blade. 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
3	1, 2	TAKE OFF <ul style="list-style-type: none"> ▪ Change in differential pressure produced by a rotating blade. ▪ Forces equilibrium and ground effect while hovering 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
4	1, 2	HORIZONTAL FLIGHT <ul style="list-style-type: none"> ▪ Impact and solutions of the variation in resultant aerodynamic force along a blade (vertical bending) and the blades assembly (conicity, axes, planes, angles) ▪ Changing the orientation of the resultant aerodynamic force to gain movement and combat parasites. ▪ Gyroscopic precession phenomenon 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
5	1,2	ANTI TORQUE <ul style="list-style-type: none"> ▪ Source and solutions of the reaction torque of the main rotor ▪ Conventional tail rotors. ▪ Delta hinge. ▪ Pitch change mechanism. ▪ Fenestron. ▪ Rotor ▪ Tandem systems. 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
6	1, 2	Exam #1	In presence at ENA	

7	1, 2	<p align="center">TRANSITIONAL FLIGHT</p> <ul style="list-style-type: none"> ▪ Flight controls ▪ Effect and solution of the lateral dissymmetry of lift. ▪ Types and arrangements of the main rotors 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
8	1, 2	<p align="center">CRUISING FLIGHT #1</p> <ul style="list-style-type: none"> ▪ Buffeting effect of the blades (Coriolis effect) ▪ Solutions for horizontal bending moments 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
9	1, 2	<p align="center">CRUISING FLIGHT #2</p> <ul style="list-style-type: none"> ▪ Balance of forces present ▪ Eccentricity 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
10	1, 2	Exam #2	In presence at ENA	
11	1,2	<p align="center">AUTOROTATION</p> <ul style="list-style-type: none"> ▪ Definition of autorotation ▪ Autorotative and anti-autorotative forces ▪ Change in angle of attack along a blade in autorotation ▪ Autorotation and anti-autorotation range ▪ Influence of the speed during horizontal flight on the autorotative zone ▪ Control of the rotor speed in autorotation ▪ Autorotation and blade inertia 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
12	1,2	<p align="center">PERFORMANCE VS ALTITUDE</p> <ul style="list-style-type: none"> ▪ Stall and compressibility ▪ Powers 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
13	1,3	<p align="center">LANDING</p> <ul style="list-style-type: none"> ▪ Main and tail rotor blade evolution ▪ Steps and pitfalls that pioneers in the development stages confronted regarding the principles of aeronautics for rotorcraft. ▪ Helicopter vibrations and ground resonance 	Synchronous with TEAMS	Microsoft Teams PowerPoint Kahoot Student manual
14	1,2,3	Exam #3	In presence at ENA	

LABORATORY

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1		Course outline and hangar visit	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
2	1,2	<p align="center">Nomenclature and safety</p> <ul style="list-style-type: none"> ▪ The history of helicopters ▪ Nomenclature of the components of a helicopter. 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components

		<ul style="list-style-type: none"> ▪ Flight controls. ▪ Swashplate. ▪ Collective and cyclic pitch change. ▪ Safety rules 		
3	2	<p style="text-align: center;">A to Z quiz</p> <ul style="list-style-type: none"> ▪ Possible types of landing gear for helicopters ▪ Different structures and construction modes 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
4	2	Landing gear and fuselage	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
5	1,2	<p style="text-align: center;">Engines</p> <ul style="list-style-type: none"> ▪ Types of engines used ▪ Components made for engines so that they can operate on helicopters ▪ Checking engine performance 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
6	1,2	Exam	In presence at ENA Research in teams of 2	PowerPoint Cell phones Any video editing software
7	1,2	Presentation	Video presentation or oral presentation	PowerPoint Cell phones Any video editing software
8	1,2	Presentation	Video presentation or oral presentation	PowerPoint Cell phones Any video editing software
9	1,2	<p style="text-align: center;">Powertrain</p> <ul style="list-style-type: none"> ▪ Drive shafts ▪ Tail rotor drive shaft ▪ Sprag clutch 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
10	1,2	<p style="text-align: center;">Preflight</p> <ul style="list-style-type: none"> ▪ Pre and post flight simulation ▪ Safety rules. 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
11	3	<p style="text-align: center;">Static and dynamic ballance</p> <ul style="list-style-type: none"> ▪ Implementing procedures ▪ Introduction to vibration analysis on rotating rotors 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
12	3	<p style="text-align: center;">Static and dynamic ballance</p> <ul style="list-style-type: none"> ▪ Alignement and static balance ▪ String method 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components
13	3	<p style="text-align: center;">Static and dynamic ballance</p> <ul style="list-style-type: none"> ▪ Vibration simulator SIMENA 	Activity in the hangar or in Lab	PowerPoint ENA helicopters Various components

14	1,2,3	Exam	In presence at ENA
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SYNTHESIS OF SUMMATIVE EVALUATION METHODS

Activity Evaluation Description	Learning context and method of evaluation	Learning Objective(s)	Evaluation Criterias	Due Date (approximate date assignment due or exam given)	Weighting (%)
Written exam no.1 Start, take off , horizontal flight and antitorque.	Individually, without course notes Duration : 2hours	1, 2	❶	6 th week	<u>Theory</u> : 20% <u>Laboratory</u> : 10% Total : 30%
Written exam no. 2 Transitional and cruising flight.	Individually, without course notes Duration : 2 hours	1, 2		10 th week	<u>Theory</u> : 20%
A presentation of your favorite helicopter using a list of criteria discussed in the course.	A 15 minutes oral or video presentation. Teams of 2 (individually evaluated)	1, 2	❷	8 th week	<u>Laboratory</u> : 10%
Written exam no. 3 Main rotors aerodynamic principle, main rotors static and dynamic balancing, helicopter pre flight and landing.	Individually, without course notes Duration : 2 hours	1, 2, 3	❶	14 th week	<u>Theory</u> : 20% <u>Laboratory</u> : 20% Total : 40%

❶ Right characterization of the physical and aerodynamic phenomena, accuracy of the links established taking into account the problematic, precise localization of components

❷ Answers accuracy given to other students questions, right distinction of the influential factors, clear explanation of the physical phenomena or principles of aerodynamics, correctness of the localization of the component.

Sub-total theory: 60%
Sub-total laboratory: 40%
TOTAL : 100%

REQUIRED MATERIAL

The only authorized calculator model for exam periods is SHARP EL 531.

MEDIAGRAPHY

LEFORT, Pierre et Hamann J. L'hélicoptère: théorie et pratique, Lyon, Chiron, 1983, 303 pages.
Réf. : 629.13335 L 494 h

RALETZ, Roger. Théorie élémentaire de l'hélicoptère, Suresne, Aérospatiale Hélicoptère, 1983, 73 pages.
Réf. : 629.13335 R 163 T

SCHAFER, Joseph. Basic Helicopter Maintenance, Basin Wyo., Aviation Maintenance, © 1980, 343 pages. Réf. : 629.1346 S 296 b

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SCHAFER, Joseph. Helicopter Maintenance, Jeppesen Sandersen.

Videos:

The story of the helicopter, 629.13335209 S887.

Rotor et son royaume, 629.133352 R848.

Vertical flight, 629.13A958 V. 11 Ex. 2

Les missions d'hélicoptère, 629.13335 P724m.

Manipulation prévol d'hélicoptère, available at the library.

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

The passing mark for this course is 60% (PIEA, article 5.1m).

(2) Attendance for Summative Evaluations

Attendance at summative evaluation activities is mandatory. (PIEA, article 5.2.5.1).

(3) Submitting Assignments

Homework required by the teacher must be handed in at the established date, place and time. The penalties associated with delays are established according to departmental rules (PIEA, article 5.2.5.2).

In case of delay the penalties are:

- See section « Règles des départements » at the following website link:
<http://guideena-en.cegepmontpetit.ca/department-rules/>

(4) Presentation of Written Work

The student must meet the "Written Work Standard Presentation" adopted by the CEGEP. Non-compliance with these standards may delay the acceptance of work or affect the rating granted. These standards are available in **Flash Links, Bibliothèques** under "**Méthodologie**" of the CEGEP Documentation Centers at: www.cegepmontpetit.ca/normes.

The **departmental penalties** for non-compliance with Written Work Standard Presentation (PIEA, article 5.3.2) are:

- See section « Règles des départements » at the following link:
<http://guideena.cegepmontpetit.ca/regles-des-departements/>

METHODS OF COURSE PARTICIPATION

For online classes (theory):

By attending online classes through videoconference technology, the student understands that his image and voice may be captured on video in the context of his courses and agrees to this. Videos are only visible during live classes and by the teacher and other participants exclusively.

For pedagogical reasons, some courses may be recorded. It is the teacher's responsibility to clearly inform students beforehand when their images and voices are to be captured on video. Any student opposed to his image and/or voice being recorded may turn off his camera and microphone but will be required to participate in writing through means established by the teacher. Otherwise, students who activate their cameras or their microphones are deemed to have agreed to their images and voices being taped. These recordings of courses will be available for the express and sole use of those students registered in the courses for the duration of the semester. It is strictly forbidden to broadcast these recordings in any public manner or to use them other than for pedagogical purposes.

No student may record an online course without prior consent from the teacher. Students whose personal information (voices and images) is captured on video may exercise such remedies as provided by the right to access records and the right of rectification per the Act respecting access to documents held by public bodies and the protection of personal information through the Cegep's Secretary General's Office.

In class, in a workshop or in a hanger:

- Food, drinks, cellphones, pagers, MP3 players, ipods, cameras and any other similar devices are prohibited.

In a workshop or in a hanger:

- ENA coveralls and safety footwear are MANDATORY. Students who do not have them will be refused access to the workshop or hangar and receive an absence in their file.
- Safety glasses are MANDATORY for working on the windtunnels and must be at hand in the hangars.
- Students may not be around the aircraft or use equipment without authorization from the instructor and they must follow instructions carefully
- It is prohibited to climb on a stool, a table or a workbench.
- There must never be more than 3 students per team unless specifically instructed by the teacher and there must never be more than one team per workbench or aircraft.
- Students must clean the workbench and put equipment away after use. In short, they ensure that the room is clean and well organized.

In the hangars:

It is prohibited:

- to bring briefcases, towels, notebooks or backpacks
- to walk around the hangars without authorization from the instructor;
- to go to another hanger without permission from the instructor;

- to use the circular staircases
 - to place a notebook or any other object on the wings or any other extremity of the planes;
 - to light a flame (e.g. lighter, matches);
 - to touch the propellers;
 - to open doors and aircraft cowling;
 - to touch handles, buttons, switches and controls on an aircraft. Respect the information written on the maintenance labels;
 - to congregate;
 - to disturb students from another course who are working on an aircraft.
- Only the teacher can lock and unlock the doors of an aircraft. Never force the opening or closing of doors. Handle them with care.
 - If a plane is on jacks, do not shake it unnecessarily. Furthermore, be careful.
 - Never jump when coming down from an aircraft.
 - It is the responsibility of the students to complete exercises on time.
 - Once the allotted time has passed, students MUST return to class.
 - Compliance with safety and work instructions is not optional; it is MANDATORY.

OTHER DEPARTMENTAL REGULATIONS

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

<http://guideena-en.cegepmontpetit.ca/departement-rules/>

INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled in the École nationale d'aérotechnique of Édouard-Montpetit CEGEP must be aware of and comply with the contents of institutional policies and regulations. In particular, the *Politique institutionnelle de la langue française (PILF)*, the *Politique pour un milieu d'études et de travail exempt de harcèlement et de violence (PPMÉTÉHV)*, the *conditions of admission and academic progress*, the *procedure dealing with student complaints within educational relations*.

The complete version of these policies and regulations is available on the CEGEP website at the following address: <http://www.cegepmontpetit.ca/ena/a-propos-de-l-ecole/reglements-et-politiques>. In case of discrepancy between the version appearing elsewhere and the complete version, the complete version will be applied and will be considered the official version for legal purposes.

STUDENT ACCESSIBILITY CENTER - FOR STUDENTS WITH DISABILITIES

Students having received a professional diagnosis of impairment (motor skills, neurological, organic, sensory, learning difficulties, mental health, autism spectrum disorder or other) or suffering from a temporary medical condition may request special accommodations.

Students seeking these accommodations must forward their diagnosis to the CSA by either MIO to « Service, CSA-ENA » or email to « servicesadaptesena@cegepmontpetit.ca ».

Students already registered with the CSA must communicate with their teachers at the beginning of the semester to discuss those accommodations they have been awarded by the CSA.

ANNEX

None