ÉCOLE NATIONALE D'AÉROTECHNIQUE

UNE ÉCOLE AFFILIÉE AU CÉGEP ÉDOUARD-MONTPETIT

280-1B5-EM

FALL 2020

Pre-Flight Department

COURSE OUTLINE

COURSE: **Introduction to Aeronautics**

PROGRAMS: 280.C0 Aircraft Maintenance

DISCIPLINE: 280 Aeronautics

WEIGHTING: Theory: 3 Laboratory: 2 Personal Study: 2

Your teachers	Office	☎ Extension	✉ Email or Website
José Marcoux	C-183	4407	Jose.marcoux@cegepmontpetit.ca
Serge Rancourt	B-122	4664	serge.rancourt@cegepmontpetit.ca

OFFICE HOURS FFOR STUDENTS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					
Other					

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

CONTEXT OF THIS COURSE IN THE PROGRAM

This course is designed for all beginning students at ENA regardless of the program they have chosen.

The fundamental knowledge acquired in this course will serve students in a number of other courses, in particular courses that involve working on aircraft and the systems that make up the aircraft. Consequently, students are strongly advised to pass this course during their first year**. In addition, students must keep this course outline and notes for the duration of their studies as it will be useful for the comprehensive assessment at the end of the program.**

The overall objective of the course is to introduce students to the construction of aircraft and the physical principles that affect flight.

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 ».

COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

To master the aeronautic maintenance work technics.

MINISTERIAL OBJECTIVE(S) OR COMPETENCIES

This course outline was written using element of each of the following competencies:

- **025N** To analyse the function of work.
- **0260** and **0268** To apply the principles of aerodynamics to flight and aircraft maintenance.

TERMINAL OBJECTIVE OF THE COURSE (Final course OBJECTIVE)

Knowing the technical terminology, the role of the aircraft different components and the basic principles of aerodynamics.

TEACHING AND LEARNING STRATEGIES

Theory:

This part of the course is made up of four modules that cover basic concepts of aeronautics and aerodynamics of helicopters and planes. Classes will be **online**. Documents and directives will be transmitted through LEA, including videos if needed. Usage of Microsoft Team will be use as a teaching tool. A weekly homework will be used to confirm comprehension of material seen.

Laboratory:

The practical part of the course is divided into three modules, two of which cover aircraft. Classes will be given **in school**. During the two modules, students will learn through exercises in the hangars. Students will experiment with wind tunnels for the module on aerodynamics in order to progressively learn the basic concepts.

Caution: exercises or preparatory activities (classroom (theory) and laboratory (practical)) requested by the teacher (s) must be completed before arriving in the classroom or lab. The teacher (s) reserves the right to deny access to the class, workshop or hangars if the exercises were not fully completed in advance and the absence will be recorded in the student's file (e). It is the responsibility of the student (s) to complete the exercises as these will be used to answer several exam questions.

If absent, the student (s) is responsible to check with their classmates what has been done and the work that has been given, and to keep up to date (see table learning objectives: synthesis of summative evaluation methods).

COURSE PLAN – THEORY

MODULE 1 – BASIC CONCEPTS 9 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Distinguish classes of aircraft and their lift mode.	▪ Classification of aircraft according to Canadian Aviation Regulations (CAR) ▪ Buoyancy, projectiles and aerodynamic forces.	Course notes. Readings and exercises as assigned by the instructor(s).
2. Identify the various categories of organizations and companies in the aviation sector and jobs related to this field.	▪ Areas of aeronautical activities (aviation, construction, maintenance and related activities). ▪ Engineers, technicians, assemblers, inspectors, drivers. ▪ Leading Manufacturers.	
3. Recognize the authorities and the documents needed to maintain security.	▪ In Canada, USA and Europe. ▪ Canadian law and CARs.	
4. Recognize the main steps in the evolution of aircraft.	▪ Historical overview of the evolution of aircraft. ▪ Major manufactures and their country of origin.	
5. Recognize the characteristics of the atmosphere and air.	▪ Composition, structure and standardization of the atmosphere. ▪ Distinction between the different physical properties of air.	
6. Recognize and use different measuring unit systems.	▪ MKSA (Metre, Kilogram, Second, Ampere) International Units System and FSS (Foot, Slug, Second) System. ▪ Definition and units: acceleration, density, force, weight, pressure, temperature, density and speed (of sound, subsonic, transonic and supersonic). ▪ Conversions (calculs)	

MODULE 2 – AERODYNAMICS 10 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Distinguish between different types speed used to estimate the flight time and the amount of fuel for the flight of an aircraft.	▪ Speed: relative, indicated, true and ground ▪ Pitot staitic system. ▪ Calculation of true air speed.	Course notes. Readings and exercises assigned by the instructor(s).
2. Recognize the static and dynamic properties of fluids.	▪ Conservation laws of flow and Fluid Power set by Venturi and Bernoulli	
3. Recognize different types of air flow.	▪ Relative wind, relative speed and airspeed. ▪ Role and description of wind tunnels. ▪ Distinction between laminar and turbulent air flow. ▪ Control of the boundary layer.	
4. Recognize the factors influencing the air resistance (drag)	▪ Origin of air resistance. ▪ List the six factors affecting air resistance on an object. ▪ Calculation of drag. ▪ Calculating the speed limit. ▪ Effect of altitude and temperature on drag.	
5. Distinguish the different types of drag.	▪ General aircraft Drag (shape, friction, Profile, parasite, induced. ▪ Solutions to induced drag.	
6. Distinguish the different types of lift.	▪ Static Lift (Archimedes' principle) and dynamic lift. ▪ Calculating the dynamic lift. ▪ Effect of altitude and temperature of on lift.	
7. Distinguish the different types of airfoil.	▪ Nomenclature of an airfoil. ▪ Distinction between an angle of attack and wing angle. ▪ Distinction between a bi-convex profile, symmetrical and asymmetrical biconvex profile.	
8. Explain physical phenomena surrounding the lift.	▪ Illustration of air flow and the distribution of pressure on each airfoil. ▪ Bernoulli's principle, deflection of air masses and impact of air molecules over a wing. ▪ Stall of a wing.	

9. Compare the different characteristics of airfoils.	▪ Characteristics of ideal profile. ▪ Classification of profiles ▪ Calculating the finesse of a profile.	
10. Recognizing the forces acting on an airplane and their interaction.	▪ Equilibrium of the forces: - Lift / weight. - Pull / drag. ▪ Nose up and down moments, and the role of the horizontal stabilizer. ▪ Axes, movements, commands, control and pitch of a plane.	

MODULE 3 – PLANES 16 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Distinguish different types of airframe structures and their components.	▪ Airfoils: roles; types; classification; profiles used; loads supported construction elements. ▪ Tail assembly: roles, types, relative surfaces, profiles used. ▪ Fuselage: roles, shapes, loads supported, construction elements, stability and control around the axes.	Course notes. Readings and exercises as assigned by the instructor(s).
2. Recognize the stability and maneuverability of an airplane in flight.	▪ Means used to achieve stability and maneuverability around the axes of the aircraft.	
3. Distinguish the main airplane systems.	▪ Flight controls: primary and secondary control surfaces. ▪ Landing gear: roles, types and configurations. ▪ Ground services: hydraulic, pneumatic and electric. ▪ Propellors: types and configurations. ▪ Environment: air conditioning, pressurisation and oxygen. ▪ Fuel: supply system.	

MODULE 4 – HELICOPTERS 4 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Recognize the main steps in the evolution of helicopters.	▪ Historical overview. ▪ Roles, missions and major manufacturer.	Course notes. Readings and exercises as assigned by the instructor(s).
2. Distinguish various components of the airframe and the flight controls.	▪ Roles of airframe components and flight controls.	
3. Recognize the mechanical and aerodynamic phenomena for movements of the helicopter.	▪ Flight controls: control of lift in intensity and direction. ▪ Types of main rotor head : rotor blade movements (pitch, flapping, drag). ▪ Distinction between stationary and translation. ▪ Autorotation.	
4. Distinguish the ways of controlling the turning effect of the helicopters.	▪ Driving torque and torque of the main rotor. ▪ Tail rotor, contrarotating rotors and air jets.	

COURSE PLAN – LABORATORY

MODULE 1 – AIRCRAFT 15 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Recognize safety rules in the workshop and hangars.	▪ Responsible behavior: - Professional ethics (compliance with safety and labor). - Importance of teamwork. ▪ Identification of emergency equipment	Course notes. Readings and exercises as assigned by the instructor(s).
2. Recognize hazards associated with traffic around aircraft.	▪ Approach and leaving procedures: propeller aircraft and helicopters. ▪ Identifying limits (distances) required in its aspiration, blast, heat and noise generated by the engines of jet aircraft.	
3. Distinguish aircraft at ENA.	▪ Aircraft identification. ▪ Aircraft characteristics.	
4. Identify the main components of an aircraft.	▪ Nomenclature: role and function.	

MODULE 2 – AERODYNAMICS 6 hours (approximately)

Learning Objectives	Content	Personal Study Activities
1. Using demonstrations, measurements and calculations, recognize the characteristics of a subsonic flow. Handle wind tunnels to assess the aerodynamics of various objects and understand the law of conservation of energy fluid contained by Bernoulli.	▪ Nomenclature related to the use of wind tunnels. ▪ The role of different components of a wind tunnel. ▪ Operation wind tunnels.	Course notes. Readings and exercises as assigned by the instructor(s).
2. Visualize and reproduce (copy) the flow of air around various objects to associate (to link) aerodynamic characteristics to different forms of objects.	▪ Air Flow, made visible by smoke, using a plate, a sphere, a wing profile, etc. ▪ Production of two different types of air flow ▪ Transition point shift. ▪ Variation of the scale of the turbulent zones in the shape and orientation of an object. ▪ Drag induced.	
3. Distinguish different forms of energy contained in the air such as pressure energy and kinetic energy.	▪ Application of Bernoulli's principle. ▪ Relation: Bernoulli - Venturi - Pitot with the aid of a Venturi tube, a Pitot-static tube, oil pressure gauges and an anemometer. ▪ Graph curves, pressure, static, dynamic and total. ▪ Calculations of static, dynamic and totale pressure as well as true and actual speeds.	
4. Identify the effects of changes in altitude on aircraft, and on the people, the liquids and the air inside the aircraft, pressurized and non-pressurized	▪ Use dome and a vacuum pump. ▪ Physical properties of fluids. ▪ Ideal Gas Law. ▪ Principle of Archimedes.	

MODULE 3 – AIRCRAFT INSTRUMENTS AND HELICOPTERS 9 hours (approximately)

Learning Objective	Content	Personal Study Activities
1. Identify and describe the function of the main instruments on board an aircraft.	▪ Names and function of the flight instruments, operation and navigation.	Course notes. Readings and exercises as assigned by the instructor(s).
2. Distinguish ENA's helicopters	▪ Identification and characteristics of helicopters. ▪ Name of manufacturers and countries of origin.	
3. Recognize the main components of helicopters	▪ Nomenclature and function	

SYNTHESIS OF SUMMATIVE EVALUATION METHODS

Theory

Description of Evaluation Activity	Context	Learning Objective(s)	Evaluation criterias	Due Date (approximate date assignment due or exam given)	Weighting (%)
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes; a calculator is necessary.	See module 1 and objectives 1 to 5 and 10 Axes, movements of module 2.	Terminology Calculations - Only the answer account. - Accuracy to 3 decimal places. - Mandatory Units.	Week 5	20%
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes; a calculator is necessary.	See objectives 6 to 10 of module 2.Objective 1 off module 3	Terminology Calculations - Only the answer account. - Accuracy to 3 decimal places. - Mandatory Units.	Week 9	20%
Written exam, mainly multiple choice answers.	Individual, in-class exam without course notes.	See objectives 2 and 3 of module 3 and module 4	Terminology	Week 14	20%

Sub-total: 60%

Laboratory

Description of Evaluation Activity	Context	Learning Objective(s)	Evaluation criterias	Due Date (approximate date assignment due or exam given)	Weighting (%)
Written exam, mainly short answer.	Individual, in-class exam in two parts. Course notes not allowed for part on subject area, notes are allowed for exercises.	See Module 1	Terminology	Week 7	20%
Written exam, mainly short answer.	Individual, in-class exam in two parts. Course notes not allowed for part on subject area, notes are allowed for exercises.	See Module 2 and 3	Terminology	Week 14	20%

Sub-total: 40%

TOTAL: 100%

REQUIRED MATERIAL

- Course Notes for the Theory part of the course (the instructor(s) will provide the number at the first course).
- Course Notes for the Laboratory (practical) part of the course (the instructor(s) will provide the number at the first course).
- The only model of calculator allowed during exams is the **SHARP EL531.**
- Dress code: See section «Santé et sécurité» at the following link : http://guideena.cegepmonpetit.ca/sante-et-securite/

MEDIAGRAPHY

Theory:

Chappuy J.P., Grégori J.P. Instruments de bord, Tome 1 : Mesure de vitesse, incidence, température, dispositifs de sécurité, compas de navigation, contrôle moteurs;Tome 3 : Instruments gyroscopiques, altimètre, variomètre, compas magnétique. Institut aéronautique Jean Mermoz, Paris, 1978. 629.135 C 4671 1978.

Féminier, Didier. Cellules et systèmes d'aéronef. Outremont, Modulo, c1982, 315 p. D 629.13431 F 329c.

Fleury, Jacques. Technologie cellule. Institut aéronautique Jean Mermoz, c1981, 410 p. D 629.13431 F618t.

Gauvin, Daniel. Aérodynamique mécanique du vol, Institut aéronautique Jean Mermoz, Paris, 1979, 281 p. A.629.1323C375a

Kermode, A.C. Mécanique du vol. traduction, Didier Féminier, Outremont, Modulo, c1982, 515 p. D 629.132 K 39m.

McKinley, Bent. Aircraft basic science. USA, Gregg Division, Mc Graw-Hill Book Company, c1970, 374 p. D 629.13 M 158b.

Raletz, Roger, Théorie élémentaire de l'hélicoptère, Suresne, Aérospatiale Hélicoptère, 1983. 629.13335 R163T

Thierry du Puy de Goyne, Yves Plays, Patrick Lepourry, Jacques Besse. Initiation à l'aéronautique. Cépaduès-Éditions, Toulouse, ©Cepad2000, 176 p.

Rice handbook of Airfoil Sections for Light Aircraft.

Histoire de l'évolution des aéronefs (diaporama) 629-1300971-H673-EX-2

Laboratory:

Jane's Encyclopedia of Aviation, R629.13005 T244J.

Jane's Pocket Book of Light Aircraft, 629.133340422 T244J.

Maintenance d'aéronefs, EA-AC 43.13-1A et 2A, D629.1346E83ac.

Schafer, Joseph. Basic Helicopter Maintenance, Basin, Wyo., Aviation Maintenance, c1980, 343 pages. 629.1346 S 296 b

How Airplane Fly (vidéo) 629.1323 H 847-EX.2 VHS (18 min.)

Les substances dangereuses, 363.19S234 (25 min.)

Sécurité au sol et sur les aéroports (vidéo) A-629.1368 - S446-EX-2 VHS (25 min.)

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 assessment activities is mandatory (PIEA article 5.2.5.1)

(3) Submitting Assignments

Homeworks required by a teacher must be submitted to the date, the place and time set. The penalties associated with delays are established according to departmental rules (PIEA, section 5.2.5.2).

In case of delay penalties are:
- See section «Règles des départements» at the following 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 of these standards may delay the acceptance of the 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-en.cegepmontpetit.ca/department-rules/
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METHODS OF COURSE PARTICIPATION

In class, workshop or hangars:

- it is forbidden to bring food, drink, cell phone, pager, MP3, iPod, camera or anything similar.

In workshop or hangars:

- ENA's coverall or the polo and pants kit, as well as glasses and safety shoes are MANDATORY. Those who do not will be denied access to the workshop or hangar and the absence will be recorded in their file. He (she) cannot use aircraft and equipment with the permission of the teacher (s) and following the instructions.
- It is forbidden to climb on a stool, a table or bench.
- It should never be more than 3 students (es) per team unless otherwise specified by the teacher (s), never more than one team per stations or aircraft.
- He (she) has to clean up the workbench and store equipment after use, in short, he (she) must be sure to leave the room clean and tidy.

In hangars:

IT IS PROHIBITED TO:
- bring suitcases, briefcases or briefcase as backpack;
- to move in the hangars without the permission of the teacher (s);
- move to other hangar without the permission of the teacher (s);

- use the stairs corkscrew and mobile platforms;
- to place a binder or other object on the wings or other external part of the aircraft;
- display an open flame (eg lighters, matches.)
- to touch the propellers;
- opening doors and aircraft cowlings;
- to touch the levers, buttons, switches and controls of aircraft. Respect written on labels maintenance information;
- be outraged;
- disturbing those (students (s) of another course) working on an aircraft.
    - Only the teacher (s) can unlock and lock the doors of the aircraft. Never attempt to open or close the doors. Handle them with care.
    - If an aircraft is on jacks, do not stir unnecessary. Also, be careful.
    - When unjacking an aircraft, do not jump.
    - It is the responsibility of the student (s) to complete the exercises on time.
    - Once prescribed by the teacher (s) of time, it must always return to class.
    - Compliance with safety and work is not optional, it is REQUIRED.

-COVID-19 Wearing the procedural mask is mandatory during activities that require social distancing to be less than 1.5 meters. The mask will be provided by the Cégep

-COVID-19 Equipments must be disinfected by students BEFORE they are used (Tools, computer, etc.)

OTHER DEPARTEMENTAL REGULATIONS

Students are encouraged to consult the website for the specific regulations for this course:
http://guideena-en.cegepmontpetit.ca/department-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 (PPMÉTEHV),), 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.

THE CENTRE FOR ADAPTED SERVICES - FOR STUDENTS WITH DISABILITIES

Students with a professional diagnosis (motor, neurological, organic, sensory, learning, mental health, autism spectrum disorder or other limitations) or with a temporary medical condition may apply for accommodations.

To access this service, send your diagnosis either by MIO to "Service, CSA-ENA" or by email to servicesadaptesena@cegepmontpetit.ca.

If you already have an accommodation plan with the CSA, you are invited to contact your teacher at the beginning of the session to discuss the accommodation measures determined by the CSA.

APPENDIX

None.