ÉCOLE NATIONALE D'AÉROTECHNIQUE
UN CAMPUS DU CÉGEP ÉDOUARD-MONTPETIT

280-1B5-EM
FALL 2014
Pre-Flight

COURSE OUTLINE

COURSE: **Introduction to Aeronautics**

PROGRAMS: 280.03 Aircraft Maintenance
280.B0 Aircraft Construction Technology
280.04 Avionics

DISCIPLINE: 280 Aeronautics

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

Your teacher	Office	☎ Extension	✉ Email or Website
Serge Rancourt	C-182	4664	serge.rancourt@cegepmontpetit.ca

OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

Coordinators	Office	☎ Extension	✉ Email or Website
Dany Charette	B-125	4661	dany.charette@cegepmontpetit.ca
Louis Guimont	B-125	4703	louis.guimont@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.

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

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) OR COMPETENCIES

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

- **011X** of construction program: To establish relationships between the characteristics of aircraft operation and construction principles.
- **025N** of aircraft maintenance program: To analyse the function of work.
- **0260** and **0268** of aircraft maintenance program: To apply the principles of aerodynamics to flight and aircraft maintenance.
- **0273** and **026G** of avionic program: To check flight management and navigation systems and analyze the work function.

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.

Lecture courses will be supported with examples, exercises, illustrations and equipment. Students are expected to take notes to reinforce their learning.

Laboratory:

The practical part of the course is divided into three modules, two of which cover aircraft. During the two modules, students will learn through situation scenarios and 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

Activity Periods: **9 hours (approximately)**

MODULE 1 – BASIC CONCEPTS

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)	

Activity Period : **10 hours (approximately)**

MODULE 2 – AERODYNAMICS

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.	

Activity Period: **16 hours (approximately)**

MODULE 3 – PLANES

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.	

Activity Period: **4 hours (approximately)**

MODULE 4 – HELICOPTERS

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

Activity Period: **13 hours (approximately)**

MODULE 1 – AIRCRAFT

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.	

Activity Period: **10 hours (approximately)**

MODULE 2 – AERODYNAMICS

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. Interpret the behavior (change) of pressure on an airfoil placed in an air flow, according to the angle of attack changes.	▪ Distribution pressures around an airfoil. ▪ Determining the stall angle of the airfoil	
5. Identify the effects of altitude changes on aircraft, and the people, the liquid 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.	
6. Differentiate pressure and forces exerted on a pressurized aircraft and justify the strength of the parts installed on such aircrafts.	▪ Use a table of pressure in the standard atmosphere. ▪ Calculate the force exerted on a window of a pressurized aircraft. ▪ Compliance with the manufacturing tolerances.	

Activity Period: **7 hours (approximately)**

MODULE 3 – AIRCRAFT INSTRUMENTS AND HELICOPTERS

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)	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. (A course will be given after the exam.)	See Module 1 and part of Module 2.	Week 5	20%
Idem.	Individual, in-class exam without course notes. (A course will be given after the exam.)	See Module 2 and Objective 1 of Module 3.	Week 10	20%
Idem.	Individual, in-class exam without course notes. (No course will be given after the exam.)	See Objective 2 of Module 3 and of Module 4.	Week 15	20%
			Sub-total:	60%

Laboratory

Description of Evaluation Activity	Context	Learning Objective(s)	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. A course will be given after the exam.	See Module 1 except for helicopters.	Week 7	15%
Idem.	Idem	See Module 2.	Week 12	15%
Idem.	Individual, in-class exam. Course notes not allowed for part on subject area, notes are allowed for exercises. A course will be given after the exam. Duration: 2 class periods.	See Module 1 (helicopters) and Module 3.	Week 15	10%
			Sub-total:	40%
			TOTAL:	**100%**

REQUIREMENTS TO PASS THE COURSE

(1) Passing Mark

The passing mark for this course is 60% which is the sum of the theoretical and practical (laboratory) parts of the course.

(2) Attendance for Summative Evaluations

Students must be present for summative evaluations and they must comply with the directives indicated by the instructor and written in the course outline.

The student attendance is mandatory for the summative evaluation activity. The student must comply with all the requirements of realization of the evaluation activity planned by the teacher which is included in the course outline.

The instructor may refuse to allow students from participating in the summative examination for unexcused tardiness.

Students may receive a mark of zero (0) for any absence that is not due to serious circumstances (illness, death in the family, major event that prevented student from attending, etc.).

Students are responsible for contacting their instructor(s) and making the necessary arrangements before the evaluation activity or immediately upon returning to ENA. Students must explain the reason for the absence and provide supporting documents. If the instructor recognizes that the reasons are serious, arrangements for the evaluation activity will be made between the teacher and the student.

(3) Submitting Assignments

All assignments must be submitted by the date, hour and location designated by the instructor(s). Late assignments will be penalized 10% per day that they are late and will receive a mark of zero (0) after one week.

(4) Presentation of Written Work

The instructor(s) will provide students with information and guidelines regarding the presentation of written work. When the presentation of an assignment is inacceptable, the work will be penalized as a late assignment until an acceptable version is submitted.

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 center on the College web site http://www.cegepmontpetit.ca/biblio under the heading **« Aide ».**

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, 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) can not 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.

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.**
- Graduated ruler in 1/10-inch gradations.

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.)

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: http://www.cegepmontpetit.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 visit the website for specific courses that the main ones are listed below rules.
http://ena.cegepmonptetit.ca/etudiants-actuels/programmes-d-etudes/departements-d-enseignement#a

(1) Course Attendance

Students are required to attend all courses and participate actively. Students who have missed 10% of the practical part (laboratory) of the course will immediately receive a warning informing them of their attendance record; when students have missed more that 20% of the practical part of the course, they will be excluded from the course.

The final mark for students who have been excluded from the course will represent the number of points accumulated at the time of exclusion.

Students who believe a mark is not justified may appeal to the administrator responsible for the department.

(2) Tardiness

Students who arrive more than 10 minutes after the beginning of the first period of a course are considered absent for this period. No late arrivals are allowed for subsequent periods of the same course.

(3) Absence of the Instructor(s) Absence de l'enseignant(e)

Students must wait 10 minutes before considering that an instructor is absent for the first period of a course and they must be present for the second hour unless an absence has been posted.

(4) Safety and Use of Department Services and Workshops or Classrooms

See the regulations for the Pre-Flight Department on the College website under the heading *Règles et politiques de l'ÉNA*

http://ena.cegepmonpetit.ca/etudiants-actuels/documents-et-consignes/regles-de-securite

(5) Mark Revisions

See Article 6.6.2 of the institutional policies for learning evaluation *(Politique institutionnelle d'évaluation des apprentissages.)*