ÉCOLE NATIONALE D'AÉROTECHNIQUE

UNE ÉCOLE AFFILIÉE AU CÉGEP ÉDOUARD-MONTPETIT

280-2A5-EM

WINTER 2023

Department of Propulsion

Course outline

COURSE: **Organic Materials Used in Aeronautics**

PROGRAM: 280.C0 Aircraft Maintenance

DISCIPLINE: 280 Aeronautics

WEIGHTING: *Theory:* 3 *Practical Work:* 2 *Personal Study:* 2

Teacher(s)	**Office**	**☎ extension**	**✉ e-mail or website**
FARKOUH, Marc-André	D-113d	4437	marc-andre.farkouh@cegepmontpetit.ca

Office hours

	MONDAY	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**
Morning	**11:00 – 12:00**	**11:00 – 12:00**			
Afternoon					**12:00 - 13:00**
Other					

Coordinator(s)	**Office**	**☎ extension**	**✉ e-mail or website**
Louis Deschênes	D-113d	4607	louis.deschenes@cegepmontpetit.ca

1 CONTEXT OF THIS COURSE IN THE PROGRAM

This course is given during the second session of the program.

By the end of the course, students will have developed their abilities to:

- Select lubricants and fuels.
- Check the quality of lubricants and fuels.
- Carry out lubricant and fuel contamination tests and analyses.
- Select a solvent to clean a part.
- Choose and carry out preparations for different types of plastics. ▪ Record information in the appropriate documents.

This course is a co-requisite with Course 280-245-EM.

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 ».

2 COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

Master the aeronautical maintenance techniques.

3 MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

025 R Master the aeronautical maintenance techniques.

4 TERMINAL OBJECTIVE OF THE COURSE (FINAL COURSE OBJECTIVE)

- At the end of this course, the student will be able to use organic and synthetic materials.

5 TEACHING AND LEARNING STRATEGIES

Theory:

While essentially delivered with a formal lecture format, a variety of pedagogical methods are used including presentations using a multi-media projector or the blackboard, use of organic parts and products as well as films. For this session, the presentations used by the teacher will be sent to you on LEA and the theoretical courses will be offered synchronously online unless there are changes in the instructions related to Covid-19.

Practical Work:

Using a variety of teaching methods, the practical work involves handling organic materials with laboratory equipment as well as laboratory technologies delivered as a lecture. Students will handle materials in teams. All the lessons in the laboratory part will take place in person, in room C21.

6 COURSE PLAN - THEORY

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	1	Saturated hydrocarbons. Physical and chemical properties. Nomenclature and classification	In class	Course presentation available on LEA
2	1	Unsaturated hydrocarbons. Physical and chemical properties. Nomenclature and classification	In class	Course presentation available on LEA
3	1	Aromatic hydrocarbons. Physical and chemical properties. Nomenclature and classification	In class	Course presentation available on LEA
4	2-3	Refining processes Chemical transformations Solvents	In class	Course presentation available on LEA
5	1-5	EVALUATION # 1	In-person. Local to be determined.	
6	4-5	Operation of internal combustion engines. MOGAS Physical and chemical characteristics	In class	Course presentation available on LEA
7	4-5	MOGAS (continued) Physical and chemical characteristics	In class	Course presentation available on LEA
8	4-5	Types of fuel Physical and chemical characteristics	In class	Course presentation available on LEA

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
9	6	Lubrication elements Basic lubrication systems (Wet & Dry sump)	In class	Course presentation available on LEA
10	6	Lubricating oils	In class	Course presentation available on LEA
11	6 7-8	Greases Polymer chemistry. Structures and classification of constituents	In class	Course presentation available on LEA
12	7-8	Thermoplastics Mechanical properties Formatting	In class	Course presentation available on LEA
13	7-8	Thermosets Fibers, reinforcements and additives Elastomers	In class	Course presentation available on LEA
14	4-8	Summary	In class	
15	4-8	EVALUATION # 2	In-person. Local to be determined.	

COURSE PLAN – THEORY

ACTIVITY PERIOD: WEEKS 1 TO 4

Learning Objectives:

1 Name the different hydrocarbons present in lubricants and fuels according to the rules of systematic nomenclature.
2 Explain the influence of the refining processes on the final petroleum products.
3 Describe the usual cleaning products and solvents, their characteristics as well as their effects on different materials.

CONTENT

- Classify solvents and cleaning products.
- Determine the reactivity, solvency and oxidation.
- Describe materials used in aeronautics.
- Determine the compatibility and incompatibility between products and parts.
- Describe WHMIS for properly handling and storing solvents.
- Understand processes for refining and their environmental effects.
- Understand saturated, unsaturated, sulfured and aromatic compounds.

ACTIVITY PERIOD: WEEKS 5 TO 8

Learning Objectives:

4 Compare different fuels according to their physical and chemical characteristics.
5 Select the proper fuel as a function of the conditions of operation, standards, specifications and recommendations.

CONTENT

- Physical and chemical characteristics of fuels: octane and performance numbers, volatility, energy of combustion, coloring, etc.
- Consequences of using automotive fuels in aviation and aviation fuels in automobiles.

ACTIVITY PERIOD: WEEKS 9 TO 13

Learning Objectives:

6 Make a judicious selection of various lubricants according to operating conditions, standards, specifications and recommendations.
7 Describe and explain the nature of plastics, composites, their characteristics and their physical and chemical properties.
8 Use resins and catalysts properly according to standards and specifications.

CONTENT

- Classifying plastics based on their nomenclature.
- Composition and structure of polymers: thermoplastics, thermosettings and elastomers.
- Different types of fiber composites: fiberglass, carbon fiber, etc.
- Understanding aeronautical applications of diverse plastics and composites.
- Defining processes of polymerization and of different catalysts.

- Regulations related to handling and storing materials (WHMIS).
- Describing functions of lubricating oil and greases.
- Describing different physical and chemical characteristics.
- Identifying different additives.
- Comparison of mineral and synthetic oils.
- Comparison of different greases.
- Classifying the performance of lubricating oils.

COURSE PLAN – LABORATORY

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	9-10-13	Security in the lab Lab procedures First aid WHMIS	In laboratory In teams of 2 or 3 students	Laboratory's notebook
2	9-10-11-12-13	Lab on the density of solvents Lab on the solubility of solvents	In laboratory In teams of 2 or 3 students	Laboratory's notebook
3	9-10-11-12-13	Lab on the calorimetric bomb	In laboratory Demonstrations by the teacher	Laboratory's notebook
4	9-10-12-13	Lab on the identification of plastics Lab on the chemical resistance of plastics	In laboratory In teams of 2 or 3 students	Laboratory's notebook
5	9-10-11-12-13	EVALUATION # 1	In-person Local to be determined	
6	9-10-11-12-13	Review of exam no 1 Introduction to oil analysis Rotary labs explanations	In laboratory Information and explanations given by the teacher.	Laboratory's notebook
7	9-10-11-12-13	Lab on the flash and fire point of oils	In laboratory In teams of 2 or 3 students	Laboratory's notebook
8	9-10-11-12-13	Lab on the viscosity of oils	In laboratory In teams of 2 or 3 students	Laboratory's notebook
9	9-10-11-12-13	Lab on the volatility of AVGAS/MOGAS	In laboratory In teams of 2 or 3 students	Laboratory's notebook
10	9-10-11-12-13	Spectrometric oil analysis Lab on the rapid test methods of oil analysis	In laboratory In teams of 2 or 3 students	Laboratory's notebook

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
11	9-10-11-12-13	Smoke point Oils emulsion	In laboratory In teams of 2 or 3 students	Laboratory's notebook
12	9-10-11-12-13	Lab on the ferrograph	In laboratory In teams of 2 or 3 students	Laboratory's notebook
13	9-10-11-12-13	Aircraft hydrocarbons/hangar	Aircraft hangars Demonstrations by the teacher	Laboratory's notebook
14	11-12	Analysis and results interpretation of reports Lab on spark advance and fuel mixture	In laboratory In teams of 2 or 3 students Demonstration by the teacher	Laboratory's notebook
15	9-10-11-12-13	EVALUATION # 2	In-person Local to be determined	

COURSE PLAN – LAB

The laboratory part of the course consists of experiments in rotation allowing students to achieve the different learning objectives. The timeline of the experiments will be distributed during the first course of the session.

ACTIVITY PERIOD: WEEKS 1 TO 15

Learning Objectives:

9 Use the different measuring instruments appropriately.
10 Handle and store fuels and lubricants appropriately.
11 Analyze results from different tests made on fuels and lubricants.
12 Make the entries in different documents when analyzing organic and synthetic materials.
13 Apply health and security and environmental regulations related to the workplace.

CONTENT

- Using experimentation standards.
- Describing laboratory equipment.
- Determining properties and characteristics of different fuels and lubricants.
- Making links between the characteristics of fuels and lubricants and engine operation.
- Identifying different physical and chemical tests.
- Using technical diagrams and data sheets.
- Using methods that respect health and safety (WHMIS).
- Identifying different types of contaminants of lubricants.

- Establishing links between the contamination of lubricants and engine operation.
- Describing special documents (measurement registration sheets, etc.)
- Describing and using required protective equipment.

7 SYNTHESIS OF SUMMATIVE EVALUATION METHODS

THEORY

Description of the evaluation activity	Context	Learning Objective(s)	Evaluation criteria	Due Date (date assignment is due or exam date)	Weighting (%)
Exam # 1. Verification of knowledge appropriation from weeks 1 to 4.	Written and in person exam. Individual for up to 3 hours, with essay and multiple choice questions.	1 to 4	Veracity and validity of statements. Quality of content and completeness. Adequate use of terminology. Understanding the operation and precision of explanation. Appropriate procedure and units for calculations.	Week 7	25%
Exam # 2. Verification of knowledge appropriation from weeks 8 to 14.	Written and in person exam. Individual for up to 3 hours, with essay and multiple choice questions.	4 to 8	Veracity and validity of statements. Quality of content and completeness. Adequate use of terminology. Understanding the operation and precision of explanation. Appropriate procedure and units for calculations.	Week 15	35%

Sub-total: 60%

PRACTICAL WORK

Description of the evaluation activity	Context	Learning Objective(s)	Evaluation criteria	Due Date (date assignment is due or exam date)	Weighting (%)
Exam # 1. Verificaion of knowledge appropriation from weeks 1 to 4.	Written and in person exam. Individual for up to 2 hours, with essay and multiple choice questions.	9 to 13 (Weeks 1 to 4)	Veracity and validity of statements. Quality of content and completeness. Adequate use of terminology. Understanding the operation and precision of explanation. Appropriate procedure and units for calculations.	Week 5	15%
Terminal course exam on the appropriate use of fuels and lubricants in aeronautics.	Written and in person exam. Individual for up to 2 hours, with essay and multiple choice questions.	9 to 13	Veracity and validity of statements. Quality of content and completeness. Adequate use of terminology. Understanding the operation and precision of explanation. Appropriate procedure and units for calculations.	Week 15	25%

SUB-total: 40% TOTAL: 100%

8 REQUIRED MATERIAL

Theory: SHARP EL 531 calculator.
Laboratory: Coop course notes, lab coat (ENA), safety glasses and safety shoes.

9 MEDIAGRAPHY

ARNAUD, P. *Cours de chimie organique*, Gauthier-Villars, Paris, 1978, 472 p.

ASM International Handbook Committee, *Engineered Materials Handbook, vol.1 (composite), vol.2 (engineering plastics)*, ASM International, 1988. ASTM, *Annual Book of ASTM Standards*, Vol 5, 1992.

DURIER, Y., *Caractéristiques des carburants et combustibles et leur influence sur le fonction-nement des moteurs*. Éd. Technip, Paris, 1971, 308 p.

GROFF, J.L.E., *ABC du graissage*, Editions Technip, Paris, 1961.

GRUSE, William A., *Chemical Technology of Petroleum*, McGraw-Hill, 1960.

GUIBET, J-Claude, *Carburants et moteurs, tomes 1 & 2*, éditions Technip, 1987.

GUTHRIE, V.B., *Petroleum Products Handbook*, McGraw-Hill, Montréal.

HARPER, Charles A., *Handbook of Plastics and Elastomers*, McGraw-Hill Book Co., 1975.

JOLICOEUR, R., *Carburants, lubrifiants et plastiques,* Griffon d'argile, 1992.

KLAMANN, D., *Lubricants and Related Products*., Verlag Chemie, 1984.

LICHTY, L.C., *Combustion Engine Processes*, 7e éd., McGraw-Hill, Toronto, 1967.

O'CONNOR, J., BOYD, J., *Standard Handbook of Lubrication*, McGraw-Hill, 1968.

SCHILLING, A., *Les huiles pour moteurs et le graissage des moteurs*, Tome 1, 2e éd., Éd. Technip, Paris, 1975.

STEELE, G.L., *Exploring the World of Plastics*, McKnight Publishing Co, 1977.

TREAGER, I., *Aircraft Gas Turbine Engine Technology*, 2e éd., McGraw-Hill, Montréal, 1979, 586 p.

WEISSMANN, J., *Carburants et combustibles pour moteurs à combustion interne*, Éd. Technip, Paris, 1970, 720 p.

10 REQUIREMENTS TO PASS THE COURSE

1. Passing Mark

The passing mark for this course is 60% by adding the marks for the theory and practical work for the course.

2. Attendance for Summative Evaluations

Students must be present for summative evaluations and must comply with the instructions given by the instructor to carry out the evaluation activity and written in the course outline. Unexcused tardiness for a summative evaluation could result in being excluded from the activity. Any absence from a summative evaluation that is not due to serious reasons (illness, death in the family, etc.) could result in a mark of zero (0) for the activity.

Students are responsible for meeting with the instructor before an evaluation activity is held or immediately upon returning to ENA to explain the reason for an absence. Proper documentation, such as a medical certificate, a death certificate, legal papers, etc., must be shown if the reason for absence is serious and recognized as such by the instructor(s), arrangements will be made between the instructor(s) and the student to make up the activity.

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. In this case, the penalties for late work will be applied.

Students must follow the standards adopted by the Cégep for written work (« *Normes de présentation matérielle des travaux écrits* »). These can be found in the documentation center on the Cégep web site www.cegepmontpetit.ca/normes under the heading ***Liens éclair*, Bibliothèques, « Méthodologie ».**

5. Laboratory attendance

Attendance at the laboratory course (PIEA, article 5.3.4d) is proof of the student's commitment to his studies. The professor must record absences in the electronic absence management system or in a register that the student can consult. In the event of repeated absences of the student, the following procedure applies: Absences without reason will be counted and a first written notice will be sent to the student by MIO following absences equivalent to 10% of the number of hours of the course (the laboratory course is 30 hours, this notice will be sent after 3 hours of absence.) It will specify the dates of absences, the number of hours of absences compiled as well as the possibility of exclusion which could lead to a failure of the course if the percentage of absences crosses the 2nd threshold. Following absences equivalent to 20% of the number of hours of the course (i.e. 6 hours), an exclusion notice will be sent to the student and to the Studies Department, which will keep the register. The penalty for absences will result in the cumulative score at the time of exclusion.

11 RULES FOR CLASS PARTICIPATION

Lab coats, safety shoes and safety glasses must be worn in the laboratory from the second class in the lab. Access to the laboratory will be prohibited to any student who is not wearing a lab coat, safety shoes and safety glasses.

It is forbidden to eat or drink (contamination) in the laboratory.

After handling, the material used must be cleaned, washed and put in its place; papers must be thrown away in the trash basket, and the workspace must be cleaned before leaving.

For online classes:
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 responsability 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.

12 OTHER DEPARTMENTAL REGULATIONS

Students are encouraged to consult the website for specific regulations related to this course:
http://guideena-en.cegepmontpetit.ca/department-rules/

13 INSTITUTIONAL POLICIES AND REGULATIONS

All students enrolled to the National Institute of Aeronautics, 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* (PIEA), la *Politique institutionnelle de la langue française* (PILF), *la Politique pour un milieu d'études et de travail exempt de harcèlement et de violence* (PPMÉTEHV), les *Conditions d'admission et cheminement scolaire,* la *Procédure concernant le traitement des plaintes étudiantes dans le cadre des relations pédagogiques.*

The full text of these policies and regulations is accessible on the Cégep web site at the following address: http://www.cegepmontpetit.ca/ena/a-propos-de-l-ecole/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.

14 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.