ÉCOLE NATIONALE D'AÉROTECHNIQUE

UNE ÉCOLE AFFILIÉE AU CÉGEP ÉDOUARD-MONTPETIT

280-2D5-EM

WINTER 2023

Department of Propulsion

Course outline

COURSE: **Aircraft Turbine Engine Operations**

PROGRAM: 280.C0 Aircraft Maintenance

DISCIPLINE: 280 Aeronautics

WEIGHTING: *Theory:* 3 *Pratical 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					

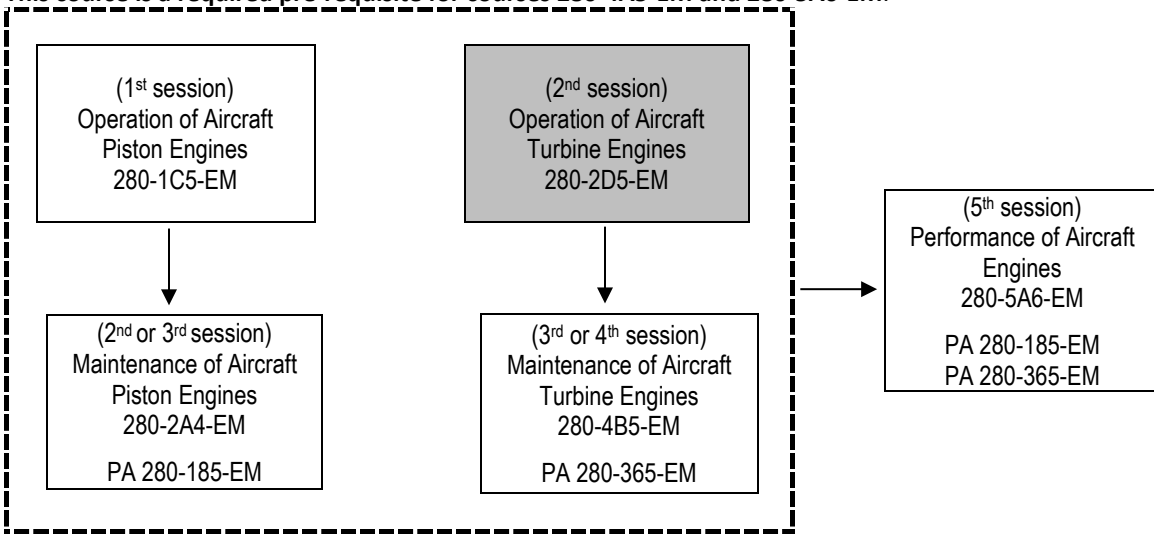
Coordinator(s)	**Office**	**☎ extension**	**✉ e-mail or website**
Louis Deschênes	D-113D	4607	louis.deschenes@cegepmontpetit.ca

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:

- Explain the principle of turbine engine operation.
- Explain the factors affecting torque or thrust.
- Explain the operation and design of different components and systems associated with turbine engines.
- Evaluate engine performance.
- Troubleshoot.
- Apply health and safety regulations related to the work area and operations on turbine engines.

This course is a required pre-requisite for courses 280-4A5-EM and 280-5A6-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)

To verify the operation of aircraft turbine engines.

3 MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

0266 To verify the operation of aircraft turbine engines.

4 TERMINAL OBJECTIVE OF THE COURSE (FINAL COURSE OBJECTIVE)

- At the end of this course, the student will be able to verify the operation of turbine engines.

5 TEACHING STRATEGIES

Theory: A variety of pedagogical methods are used including PowerPoint presentations with a multi-media projector or blackboard, use of propulsion models and engine parts; however, the major part of the course is conducted as a formal lecture with formative exercises at the end of certain themes. 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: The laboratory part of the course is devoted primarily to techniques to help students learn about the operation of aircraft turbine engines and their peripheral systems. Using a variety of teaching methods, the practical work involves a hands-on approach to understand the components and systems that make up an aircraft turbine engine as well as lectures and demonstrations to explain laboratory technologies. All the lessons in the laboratory part will take place in person, in room D44, D12a.

6 COURSE PLAN THEORY CLASS (COURSE PLAN SCHEDULE IS SUBJECT TO CHANGE)

LEARNING OBJECTIVES – THEORY CLASSES

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	1.1 & 1.3	• Course Outline (explanation of course progress and basic rules review) • Introduction to jet engine operation and classification of these engines. (Types, sections, Stations…)	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
2	1.1 & 1.3	• Classification and comparison of turbine engines vs piston engines. (Brayton cycle)	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
3	1.1 & 1.3	• Inlet duct • Introduction to compressors	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
4	1.1 & 1.3	• Compressors (continuation)	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
5	1.1 & 1.3	• Compressors instability	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS

LEARNING OBJECTIVES – THEORY CLASSES (cont.)

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
6	1.1 & 1.3	• Combustion chamber • Diffuser • Fuel nozzles	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
7	1.1 & 1.3	• Turbine and exhaust system	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
8	1.1 & 1.3	Summative **EVALUATION 30%**	• In person, closed book (local to be determined)	
9	1.2	• Calculation: ○ Review units, define forces, work and power ○ Net thrust and gross thrust. ○ Power SHP, ESHP and THP ○ Corrected thrust (power)	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
10	1.2	• Calculation: ○ Specific fuel consumption, thermal efficiency and propulsive efficiency ○ Engine performance evaluation. (Engine efficiency)	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS

LEARNING OBJECTIVES – THEORY CLASSES (cont.)

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
11	1.4	• Fuel systems and major components	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
12	1.4	• Anti-icing systems. • Thrust augmentation systems. • Ignition and starting systems.	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
13	1.4	• Noise suppressors. • Thrust reversers.	• Synchronous presentations • Online (TEAMS) review and question periods during normal scheduled classes time • Teacher available for questions during office hours (availability hours)	• PowerPoint presentations with audio comments on YouTube (link for presentation will be given on LÉA – Omnivox) • Question periods will be done on TEAMS
14	All	Summative **EVALUATION 30%**	• In person, closed book (local to be determined)	• ÉNA approved pocket calculator

COURSE PLAN – THEORY

The theoretical part of the course is divided into major themes:

1. GENERAL POINTS ABOUT JET ENGINES covers the overall operation of various turbine engines used in aerospace.

2. PERFORMANCE CALCULATIONS AND PARAMETERS that affect the performance of aircraft turbine engines.

3. SYSTEMS cover the systems necessary for the operation of aircraft turbine engines.

ACTIVITY PERIODS:

Theme 1: GENERAL POINTS ABOUT JET ENGINES (Weeks 1 to 7)

Learning Objectives: 1.1, 1.3

Content

1.1 Explain the operation principles of different types of turbine engines.

- Introduction to jet engine operation and classification of these engines.

1.3 Explain the operation and design of different components of turbine engines.

- Air intake section: operating principle, adaptation to flight speed, efficiency, types of air intake (test bench, subsonic, supersonic), etc.
- Compressor section: types of compressors (axial and centrifuge), multi-disk system and materials used, fastening blades and stators, balancing, stalling and surging, efficiency and rate of compression, etc.
- Combustion chamber section: materials used, different types of chambers (separated, annular, and mixed), role of various internal air flows, efficiency, etc.
- Turbine section: types, role and efficiency, stress and strain affecting materials used, blade attachments and vanes, etc.
- Exhaust section: presentation of different types (variable and convergent nozzle) and materials used, etc.

Theme 2: CALCULATIONS OF PERFORMANCE (Weeks 8 to 11)

Learning Objective: 1.2

Content

1.2 Explain the factors affecting torque or thrust.

- Physics and mathematical principles associated with generating torque and thrust Brayton Cycle, calculations of thrust, power and performance evaluation, etc.

Theme 3: SYSTEMS (Weeks 12 to 14)

Learning Objective: 1.4

Content

1.4 Explain the operation and design of the systems associated with turbine engines:

- Fuel system and fuel metering, types of governors, heaters, filters and fuel system instrumentation and fuel consumption, etc.
- Ignition: high- and low-tension systems and their components, precautions to take when handling, etc.
- Starting: various starters and operation of an automatic starting system and in-flight relight system principle, etc.
- Presentation of anti-icing cooling systems and their components.
- Noise suppressing: principle of noise suppression and different types of suppressors, etc.

Personal Study Activities: Students must read the weekly readings that precede the course. As the course progresses, they must also answer formative questions asked by the instructor or used in the course notes.

COURSE PLAN - LABORATORY

LEARNING OBJECTIVES

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	**1.1, 1.3**	• Course Outline. • Turbine engine Introduction: Name, explain and compare types of jet engines. • Exercise: Identification and engines technical data sheet (Viper, Orenda, PT6 , PW100… or others).	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
2	**1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 4.1, 5.1, 5.2, 5.3, 6.1, 7.1,8.1 and 8.2**	• PT6 turbine engine introduction. Understanding the engine function. • Understanding the function of turbine engine lubricating system.	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
3	**1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 4.1, 5.1, 5.2, 5.3, 6.1, 7.1,8.1 and 8.2**	• Turbine engine oil system schematic comprehension. • Exercise: Oil flow schematic (PT6… or others)	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
4	**1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 4.1, 5.1, 5.2, 5.3, 6.1, 7.1, 8.1 and 8.2**	• Turbine engine lubrication exercises. (Oil filter and PRV inspection)	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
5	**1.1 ,1.2, 1.3, 1.4, 2.1, 2.3, 5.2 and 5.3**	• Handling engine and compressor module. (Engine manipulation and thrust reverser application. (Avon, Spey,JT8D, RB211…or others)	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
6	**1.4, 2.1, 2.3, 3.1, 3.2, 3.3, 5.2, 5.3, 6.2, 6.3, 7.2 and 7.3**	• Introduction to inspection terminology. • Demonstration of a HSI on a PT6A-27. Exercise: Intern visual inspection, Borescope utilisation. (JT8D, PW100, JT15D, PT6…or others)	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
7	**1.1 to 1.6, 2.1 to 2.3, 5,1 to 5.3 *General points * Security**	Evaluation #1	In-person Local to be determined	
8	**2.3, 3.1 à 3.3, 6.2, 6.3, 7.2 and 7.3**	• Turbine engine cold section components.	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
9	**2.3, 3.1 à 3.3, 6.2, 6.3, 7.2 and 7.3**	• Hot section: Exercise: HSI (PT6...or others) • NG side: Fuel Nozzles, CC, Turbine tip clearance, Engine reassembly. • NF side: Turbine, exhaust	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
10	**2.3, 3.1 à 3.3, 6.2, 6.3, 7.2 and 7.3**	• Hot section (PT6 HSI film, OH Rolls-Royce…) Exercise: Fuel nozzles and ignition system operation.	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
11	**2.1, 2.3, 3.1 à 3.3, 6.2, 6.3, 7.2 and 7.3**	• Measure and define different turbomachines power. EPR, Fan, TQ… • Exercise: Gear ratio, Torque meter (PT6, PW100…or others) Engine condition trend monitoring and troubleshooting. (ECTM and engine limits) Exercise: ECTM analysis, fuel nozzles, HSI, Compressor wash…) PT6 operating limits (T5 starting limit, T5 max power Limit, TQ max power limit).	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
12	**1.3, 1.4, 4.2, 4.3 and 7.2**	• Demonstration of turbine test cell operation. Exercise: introduction and demonstration of PT6-A28).	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
13	**1.3, 1.4, 4.2, 4.3 and 7.2**	• Test cell operation (by team). Exercise: Engine performance conditions and graph analysis.	In laboratory In teams of 2 or 3 students	Laboratory's notebook and / or class notes.
14	**All * General Points * Security**	Evaluation #2	In-person Local to be determined	

COURSE PLAN - LABORATORY

The laboratory part of the course is divided into five themes:

1. Turbine operation.
2. Operation of the lubrication and torque system.
3. Test cells, understanding components operation, borescope inspection.
4. Introduction to inspection terminology and troubleshooting.
5. Engine systems.

ACTIVITY PERIODS

Theme 1: OPERATION OF JET ENGINES (Week 1)

Learning Objectives: 1.1 and 1.3

1.1 Explain the operating principles of different types of turbine engines.

- Introduction to operation of engines generating torque, thrust and of the range of uses of different types of turbine engines.

1.3 Explain the operation and design of different components of turbine engines.

Content

Explanation of the general mode of operation, the differences, the names and the general identification of their components using the following engines: Orenda 8 turbo-reactor, PT6A-27 turboprop, Allison 250 C20 turbo engine, RB211 and JT8D turbofan.

Theme 2: OPERATION OF THE LUBRICATION AND ENDOSCOPY SYSTEM (Weeks 2 and 6)

Learning Objectives: 1.4, 2.1, 2.3, 5.2 and 5.3

1.2 Explain the factors affecting torque and thrust.

1.4 Explain the operation and the design of the systems associated with turbine engines:

- Lubrication systems: types of oils and necessary requirements; wet and dry sump circuits and their components, etc.
- Air systems: introduction to anti-icing and cooling circuits.

2.1 Apply safety regulations related to the inspection of internal parts of turbine engines.

2.3 Analyze inspection results and record them in the appropriate documents:

- Inspect the condition of the accessory and reduction gear box.

5.2 Use the procedure described in the manufacturer's manuals for the inspection of turbine engine lubricating systems:

- Demonstrate proper use of protective equipment, of the safety area around the workplace and show respect for precautions to be taken while handling engine systems.

5.3 Analyze inspection results and record them in the appropriate documents:

- Meticulously inspect the lubricating systems oil filter and chip detectors and adjust the pressure regulator.

Content

1. Lubrication Schematic:

- Explanations and comprehension exercises of the lubrication system operation will be made using oil system diagrams, cut-away engine and engine simulation software.

2. Reduction Gearbox (RGB):

- Explanation of the reduction principle; the necessity for reduction, types of speed reducers and their operation (gears, the planets, etc.) using disassembled PT6A-27 reduction gear boxes.

Theme 3: Test Bench (Weeks 5 to 10)

Learning Objectives: 2.3, 3.1 à 3.3, 6.2, 6.3, 7.2 and 7.3

2.3 Analyze inspection results and record them in the appropriate documents.

3.1 Apply safety regulations related to inspecting ignition systems.

3.2 Follow the procedure described in the manufacturer's manual for inspecting ignition systems:

- Use protective equipment, establish a security zone around the work area and show respect for precautions to be taken while handling parts and equipment

3.3 Analyze inspection results and record them in the appropriate documents. :

- Inspect overall condition of the ignition system at high voltage and low voltage, inspect spark plugs and the ignition box.

6.2 Inspect engine instrumentation according manufacturer's manual recommendations.

6.3 Analyze inspection results and record them in the appropriate documents.

- 7.2 Inspect turbine engine control system according to manufacturer's manual recommendations: Carry out detailed inspection of the overall condition of the engine monitoring system; carry out precise operating test runs that includes collecting detailed data from the performance test.

7.3 Analyze inspection results and record them in the appropriate documents:

- Respect engine operating limits.
- Record inspection results in specialized documents or logbooks.

Content

1. Introduction to the test cell.
2. Carry out virtual and real engine tests (PT6A27):
   - Consult documentation and relevant regulations.
3. Evaluate engine performance.
   - Borescope Inspection: Using borescope software and borescope, carry out a hot end inspection of different engines; for example: PT6A-27, PW100, JT15D, JT8D and RB211-22B.
   - Engine components operation.
   - Using manufacturer's manuals, find the operation of engine components such as the oil cooler, hot air valve, etc.

Theme 4: INTRODUCTION TO INSPECTION TERMINOLOGY, TYPES OF INSPECTIONS AND TROUBLESHOOTING (Weeks 11 to 13)

Learning Objectives: 2.1

2.1 Apply safety rules related to the inspection of internal parts of turbine engines:

- Describe specialized documents ("z" sheet, inspections and work documents).
- Research and explain laws and regulations related to inspecting the operation of turbine engines.
- Describe log books and maintenance entries.

Content

1. Introduction to ECTM:
   - Situation scenarios of different kinds of engine failures in order to find solutions.
2. Introduction to maintenance inspection terminology.
3. Demonstration of an HSI of a PT6A-27.
4. Carry out a brief HSI of a PT6A-27.

Theme 5: OPERATION OF THE ENGINE SYSTEMS (Week 14)

Learning Objectives: 1.3, 1.4, 4.2, 4.3 and 7.2

1.3 Explain the operation and design of different components of turbine engines:

- Ejection section: introduction to different types.

1.4 Explain the operation and design of turbine engine's auxiliary systems:

- Explain fuel systems and metering system types of FCU: fuel nozzles; fuel heaters; filters and fuel system indicators; fuel consumption, etc.

4.2 Use the procedure described in the manufacturer's manual for inspecting fuel systems for turbine engines:

- Use protective equipment, establish a security zone around the work area and show respect for precautions to be taken while handling parts and equipment

4.3 Analyze inspection results and record them in the appropriate documents:

- Perform detailed inspection of fuel filters, fuel injector nozzles, the fuel pump and fuel control unit; check for fuel contamination and make precise adjustments of the engine control linkage.

7.2 Use the procedure described in the manufacturer's manual for the inspection of turbine engine control systems.

Content

1. Fuel system:
   - Demonstration of the operation of fuel nozzles.
2. System operation:
   - Demonstration of the operation of thrust reversers: JT8D and RB211-22B.
   - Inspection of fuel nozzles.
   - Maintenance inspection exercise. For example: check the overall condition of the lubricating system and the oil filter and the precisely adjust the oil pressure regulator.
   - Inspection of the ignition system.

N.B.: Learning Objectives 1.5, 1.6, 2.2, 4.1, 5.1, 6.1, 7.1, 8.1 and 8.2 apply to all laboratory courses.

Safety rules, standard operating procedures of overall or specific inspection:

1.5 Identify the safety rules related to working on turbine engines:

- Instrumentation/sensors: pressure indicating system, temperatures, speed and flow sensors, etc.
- Examples of applications of different systems.

1.6 Consult appropriate documentation and regulations for checking the operation of turbine engines:

- Procedures for safely handling material.

2.2 Apply safety rules related to inspecting internal turbine engine parts:

- Describe specialized documents (registration sheets for measurements, inspections and work documents).
- Research and explain the laws and regulations that apply to inspecting the operation of turbine engines.
- Describe log books and maintenance entries.

4.1 Apply safety rules to the inspection of turbine engine fuel systems:

- Respect the limits described in the manuals or documents accompanying the engine.
- Record inspection results in specialized documents or in log books.

5.1 Apply safety rules related to inspecting turbine engine lubricating systems:

- Respect the limits described in the manuals or the documents accompanying the engine.
- Record inspection results in specialized documents or in the log books.

6.1 Apply safety rules related to inspecting the instrumentation used on turbine engines:

- Use protective equipment, establish a security zone around the work area and use caution r while handling parts and equipment.

7.1 Apply safety rules relative to the inspection of turbine engine control systems:

- Use protective equipment, establish a security zone around the work area and use caution while handling parts and equipment.

8.1 Apply health and safety rules related to the work environment:

- Use necessary protective equipment (glasses, gloves, masks, etc.)

8.2 Apply environmental rules regarding the work environment:

- Dispose of organic material in the appropriate place; put rags to be washed in the designated tub and make sure the work area is clean.

Personal Study Activities: Students must read the lesson assigned before the class on a weekly basis. As the course progresses, they must also answer (if asked) the formative questions asked by the instructor or used in the notes of the course manual.

7 SYNTHESIS OF SUMMATIVE EVALUATION METHODS

The evaluations are traditional and/or multiple choice and/or schematic.

Theory

Description of the evaluation activity	Context	Learning Objective(s)	Evaluation criteria	Due Date (date assignment is due or exam date)	Weighting (%)
Exam #1	Written and in person exam. Individual Up to 3 h	1.1, 1.3 and 1.4	• Veracity and Validity of Statements • Quality of content and completeness • Appropriate use of terminology. • Understanding of the functioning and accuracy of the explanation	Week 8	30%
Exam #2	Written and in person exam. Individual Up to 3 h	1.1 to 1.4	• Veracity and Validity of Statements • Quality of content and completeness • Appropriate use of terminology. • Understanding of the functioning and accuracy of the explanation	Week 15	30%

Sub-total: 60%

Laboratory

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 6	Written and in person exam. Individual Up to 2 h.	1.1 to 1.6, 2.1 to 2.3, 5,1 to 5.3 *General points * Security	• Veracity and Validity of Statements • Quality of content and completeness • Appropriate use of terminology. • Understanding of the functioning and accuracy of the explanation	Week 7	15%
Exam #2 Terminal course exam Verificaion of knowledge appropriation from weeks 1 to 14	Written and in person exam. Individual or in groups Up to 2 h.	All * General Points * Security	• Veracity and Validity of Statements • Quality of content and completeness • Appropriate use of terminology. • Understanding of the functioning and accuracy of the explanation	Weeks 15	25%

Sub-total: 40%
TOTAL: 100%

** General Points: On all laboratory courses: 1.5, 1.6, 2.2, 4.1, 5.1, 5.2, 6.1, 7.1, 8.1 and 8.2*

* Security: Security applicable at all times. Assessments are traditional, multiple choice, schematic or practice. Only the recommended calculator is permitted. The teacher can provide access to various facilities. In all cases the maximum allotted time factor is a criterion for performance evaluation of the student. Absence or plagiarism assessment leads automatically mark it ZERO

8 REQUIRED MATERIAL

- Safety equipment must be worn in the laboratory course: safety shoes or boots, safety glasses, ENA shop coat or overalls.
- Appropriate course manual(s).
- Cleaning rag (ENA)
- Calculator « Sharp EL 531 ».

9 MEDIAGRAPHY

Author	Publisher	Edition	ISBN	# pages
Baskharone Erian A.	Principles of Turbomachinery in Air-Breathing Engines *Cambridge Aerospace Series*		0521858100	
Crane Dale	Aviation Maintenance Technician Series : Powerplant *ASA*	2e	1-56027-547-2	776
Dole Charles	**Mathematics & Physics for Aviation Personnel** ***Jeppensen***		0-89100-399-1	94
Dreska Sister Noel & Leonard Weisenthal	Physics for Aviation *Jeppesen*		0-89100-411-4	178
Enga John	Aircraft Inspection & Maintenance Records *Jeppesen*		0-88487-391-6	84
Flack Ronald D.	Fundamentals of Jet Propulsion with Applications *Cambridge Aerospace Series*		0521819830	
Hurst Dale	Aircraft Powerplant Maintenance *Avotek*		0-9708109-3-8	423
Jeppesen	JAA ATPL, Volume 5 : Powerplant *Jeppesen*			
Jeppesen	A&P Technician Powerplant Textbook *Jeppesen*		0-88487-338-2	672
Jeppesen	**Aircraft Fuel Metering Systems** *Jeppesen*		0-89100-057-7	71
Kroes Michael & James Rardon	**Aircraft Basic Science** *McGraw-Hill Ryerson*	7e	0-02-801814-1	448
Kroes Michael & Thomas Wild	**Aircraft Powerplants** *McGraw-Hill Ryerson*	7	0028018745	656

Lombardo David	**Advanced Aircraft Systems** *McGraw-Hill Ryerson*	1e	007038603x	368
Otis Charles E. & Peter A. Vosbury	**Aircraft Gas Turbine Powerplants (text book)** *Jeppesen*		0-88487-294-7	513
Pratt & Whitney	**Aircraft gas turbine engine and it's operation** ***Pratt & Whitney***			
Pratt & Whitney	PT6A-27, PW100, JT15D et JT8D Overhaul, Maintenance & Illustrated Parts Catalogs *Pratt & Whitney*		n/a	
Rolls-Royce	Allison 250 C20J, Spey, AVON, DART et RB211-22B Overhaul, Maintenance & Illustrated Parts Catalogs Rolls-Royce		n/a	
Rolls-Royce	**The Jet Engine** ***Rolls-Royce***		0-902121-2-235	288
Transports Canada	**Transport Canada**		n/a	
Treager Irwin	**Aircraft gas turbine engine technology** *McGraw-Hill Ryerson - Glencoe Aviation Technology*	3	0028018281	677
Wild Thomas & Ronald Sterkenburg	**Aircraft Turbine Engines** ***Avotek***		1-233182-14-2 978-1-933189-14-7	

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 ».**

METHODS OF COURSE PARTICIPATION

Work clothes (ENA)
Safety glasses
Safety shoes

The use of computers belonging to students as well as the use of any audio or video recording device is forbidden in class.

Theory:

- The instructor may have specific requirements or prohibitions to improve class management. These may be explained at the beginning of the course or during the session.

Practical Work (Laboratory):

- Students must read assigned readings before class and, as the course advances, answer formative questions asked by the instructor or used in the course notes.
- The teacher may have specific requirements or prohibitions to improve class management. These may be explained at the beginning of the course or during the session.
- After handling equipment, the material and manuals used must be cleaned and returned to their proper place; papers must be thrown out in the trash baskets and the work area must be cleaned.
- The contents of the toolbox must be checked and put in order before and after each course.
- Attendance, involvement and demonstrated professionalism is taken into account in marking the laboratory reports.
- Food and drink are prohibited in the laboratory.

Instructors who consider that these conditions have not been met may take off points from the laboratory mark.

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.

11 OTHER DEPARTMENTAL REGULATIONS

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

12 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* (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.

NOTE: This Course Outline is a translation of the *Plan de cours* for 280-435-EM:
Fonctionnement de moteurs à turbine d'aéronefs.
If there is a discrepancy, then the original French version will be considered the official version for legal purposes.

13 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.

14 APPENDIX

The activity periods in the Course Outline are approximate. Changes may be made to adapt to any logistical problems that might arise during the session.