

COURSE OUTLINE

COURSE: Maintenance of Turbine Engines

PROGRAM: 280.C0 Aircraft Maintenance Technology

DISCIPLINE: 280 Aeronautics

WEIGHTING: Theory: 1 Practical Work: 4 Personal Study: 1

Instructor(s)	Office	☎ extension	✉ e-mail or website
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OFFICE HOURS

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					

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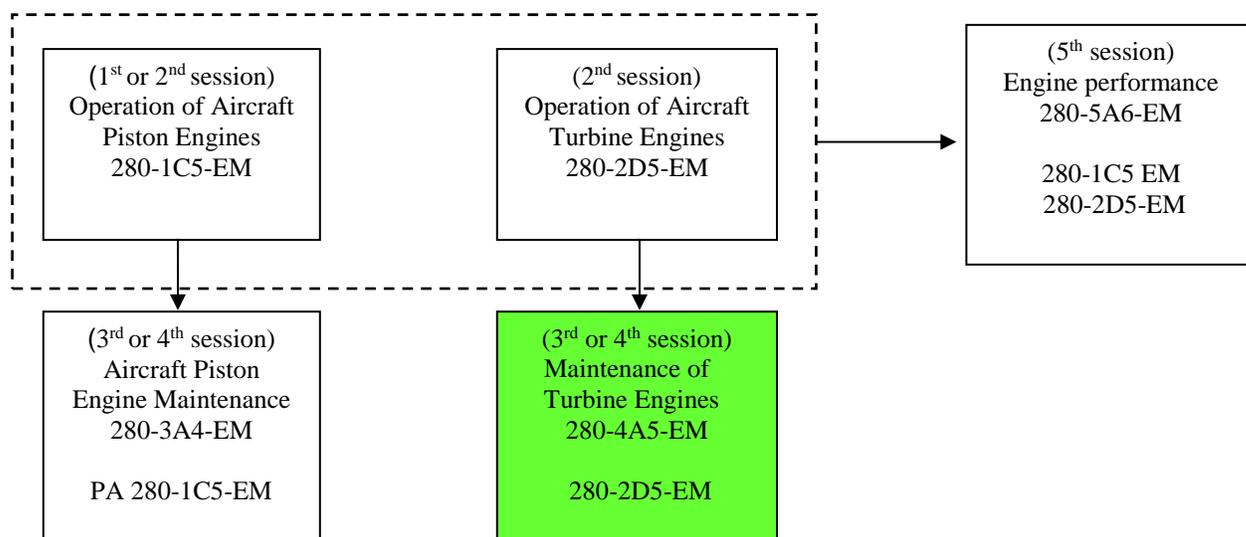
CONTEXT OF THIS COURSE IN THE PROGRAM

This course is given during the third or fourth session of the program.

The course 280-2D5-EM is a required pre-requisite.

By the end of this course, students will have developed the ability to:

- Identify the latest instructions (updates) for overhauling an engine in technical documentation and regulations.
- Identify the overhaul operations to perform from the results of the verification already recorded in the special documents and logbooks.
- Prepare the work area as well as the equipment and hardware necessary to carry out overhaul operations.
- Use the procedure described in the manufacturer's manuals for removal and installation of turbine engine components.
- Use the procedure described in the manufacturer's manuals for disassembling, cleaning, inspecting and reassembling turbine engines.
- Use proper visual, dimensional and non-destructive inspection tools on turbine engine parts.
- Using a maintenance manual, evaluate the possibility of repairing engine parts.
- Use repair tools and equipment properly
- Use special equipment test benches to check operation compliance on an overhauled engine.
- Determine whether the overhauled engine complies with the manufacturer's standards.



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 ».

COMPETENCIES OF THE EXIT PROFILE (STUDENT SKILL PROFILES)

Perform maintenance on engines.

MINISTERIAL OBJECTIVE(S) AND COMPETENCIES

026A Perform maintenance and overhaul activities on turbine engines.

TERMINAL OBJECTIVE OF THE COURSE (FINAL COURSE OBJECTIVE)

At the end of this course, the student will be able to perform maintenance and overhaul activities on turbine engines.

Theory:

Teaching strategy

A variety of pedagogical methods are used including PowerPoint presentations with a multi-media projector and use of the whiteboard; the major part of the course is conducted as a formal lecture with formative exercises at the end of certain themes.

Practical work:

Teaching strategy

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.

COURSE PLAN – THEORY

The theoretical part is divided into three major themes:

1. First: DOCUMENTATION AND REGULATIONS for overhauling aircraft turbine engines.
 2. Second: STANDARD PRACTICES when providing maintenance on aircraft turbine engines.
 3. Third: COMPLIANCE TESTING of aircraft turbine engines.
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ACTIVITY PERIODS

THEME 1: DOCUMENTATION, REGULATIONS AND RECORDING OPERATIONS, Weeks 1-4

Learning Objectives: 1.1 and 1.2

CONTENT

- 1.1 Consult documentation and regulations relevant to the overhaul of the specific turbine engines:
 - Review of hazardous materials and safe handling (WHMIS and the environment).
 - Laws, regulations and standards specific to the overhaul of turbine engines.
 - Relevant documents for engine overhaul (M.M., O.M., I.P.C., S.B., A.D., etc.).
- 1.2 Explain the differences between the model numbers of turbine engines:
 - Classify the models of turbine engines to be used in class

THEME 2: STANDARD PRACTICES, Weeks 5 - 9

Learning Objectives: 3.2, 4.3, 5.1,5.2,5.3 6.4, 7.3 and 8.3

CONTENT

- 3.2 Use the procedure described in the manufacturer's manuals for removing turbine engine components:
 - Apply standard practices in removing components (Labels, plugging holes, wrapping, padding, storage, etc.)
- 4.3 Use the procedure described in the manufacturer's manuals for disassembling turbine engines:
 - Apply standard practices in dismantling turbine engines (labels, plugging holes, wrapping, padding, storage, etc.)
- 5.1 Use protective equipment and establish a safe area around the work area.
 - Application of safety rules for inspection of engine parts
 - Handling parts with care.
- 5.2 Wash the parts to be inspected following the manufacturer's procedures.
 - Equipment and specialized tools recommended by the manufacturer
- 5.3 Use proper tools for visual, dimensional and non-destructive inspection on turbine engine parts:
 - Apply standard practices for inspecting turbine engine parts
 - Review of the use of inspection tools
- 6.4 Use repair tools and equipment properly:
 - Apply standard practices to repair engine parts
- 7.3 Use the procedure described in the manufacturer's manuals for assembling turbine engines:
 - Apply standard practices in assembling turbine engines
 - Comply with the procedure for applying torque
 - Clean with a cloth and visually inspect the assembled parts of the engine
- 8.3 Use the procedure described in the manufacturer's manuals for installing the components of turbine engines:
 - Apply standard practices for installing components
 - Comply with the procedure for applying torque
 - Follow the procedure recommended by the manufacturer for installing components
 - Adjust the installed components by following the manufacturer's procedure
 - Visually inspect and check compliance of the installed parts and components

THEME 3: COMPLIANCE TESTING, Weeks 10 - 13

Learning Objectives: 9.1 to 9.7

CONTENT

- 9.1 Use protective equipment and set up a safe area around the workplace:
 - Implement safety rules while working on turbine engines.
 - Observe safety precautions while handling and using test benches.
- 9.2 Use special equipment and test benches properly to check compliance of the overhauled engine:
 - Apply standard practices in testing turbine engines
- 9.3 In accordance with the manufacturer's recommendations, start the engine.
- 9.4 In accordance with the manufacturer's recommendations, check engine for proper operation.
- 9.5 In accordance with the manufacturer's recommendations, check engine compliance (performance, acceleration, etc.).
- 9.6 In accordance with the manufacturer's recommendations, shut down the engine.
- 9.7 Determine overhauled engine compliance with manufacturer's recommendations.

PERSONAL STUDY ACTIVITIES

Students must read the assigned readings the week before class. They must also answer respond to the formative questions assigned by the teacher or used in the course notes.

COURSE PLAN – LABORATORY

The theoretical part is divided into five themes:

1. FAMILIARISATION and DISMANTLING of an aircraft turbine engine module.
2. INSPECTION of parts and components of an aircraft turbine engine and REPAIRS.
3. ENGINE COMPLIANCE TESTING of an aircraft turbine engine.
4. REASSEMBLY of an aircraft turbine engine module.
5. ADJUSTING INSTALLED COMPONENTS.

Using a variety of teaching methods, the practical work involves a lecture format to explain laboratory technology as well as a hands-on approach to understand the handling of equipment and/or systems allowing students to have a detailed understanding of the operation of aircraft turbine engines and their systems.

ACTIVITY PERIODS

THEME 1: ENGINE FAMILIARISATION AND DISMANTLING: Weeks 1 to 8

Learning Objectives: 1.1 to 1.4, 2.1, 2.2, 3.1 to 3.5 and 4.1 to 4.5

- 1.1 Consult the documentation and regulations that apply to the overhauling of turbine engines that is to be performed.
- 1.2 Explain the differences in turbine engine model numbers.
- 1.3 Locate and reassemble the documentation and regulations that apply to the overhaul.
- 1.4 Find the latest directives that apply to the engine to be overhauled. (A.D.)
- 2.1 Determine work scope in accordance with operator's request and logbook information .
- 2.2 Using a computer system, explain how to check the availability and how to order the necessary material, parts and hardware to carry out the operation.
- 3.1 Use protective equipment and establish a safety area around the workplace.
- 3.2 Follow the procedure described in the manufacturer's manuals for the removal of turbine engine components.
- 3.3 Perform a visual inspection of the removed parts and components.
- 3.4 Lay components on shelves properly. (tagging, plugging holes, wrapping, etc.)
- 3.5 Record information in the appropriate documents.
- 4.1 Use protective equipment and establish a safe area around the workplace.
- 4.2 Properly use the special tools for dismantling.
- 4.3 Follow the procedure described in the manufacturer's manuals to disassemble the engine.
- 4.4 Wipe, visually inspect, identify and store the engine parts.
- 4.5 Lay components on shelves properly.

CONTENT

1. Become familiar with the equipment and engine and know what operations to carry out.
2. Prepare and carry out equipment orders.
3. Research the SB-AD of an engine. For example, the PT6A-27.
4. Perform induction procedure and disassemble Allison 250 C20J engine.
5. Record findings and determine corrective actions.

THEME 2: INSPECTION, Week 10

Learning Objectives: 5.1 to 5.6

- 5.1 Use protective equipment and establish a safe area around the workplace.
 - Apply safety rules related to inspecting engine parts.
 - Respect safety precautions when handling parts and equipment.
- 5.2 Wash the parts to be inspected while following manufacturer's procedures:
 - Use the specialized equipment and tools recommended by the manufacturer.
- 5.3 Properly use visual, dimensional and non-destructive tools on the parts of the turbine engine.
- 5.4 Follow the procedure described in the manufacturer's manual to inspect each part.
- 5.5 Analyze the inspection results to determine whether the part should be repaired or replaced.
- 5.6 Order the parts to be replaced.

CONTENT

1. Inspect the compressor.
2. Inspect components of the hot section: turbine, combustion chamber.
3. Record findings and recommend actions to take.

THEME 3: ENGINE COMPLIANCE TESTING, Weeks 9 to 11

Learning Objectives: 9.1 to 9.7

- 9.1 Use protective equipment and establish a safe area around the workplace.
- 9.2 Properly use special equipment and test benches for the compliance test of the overhauled engine.
- 9.3 In accordance with manufacturer's recommendations, start the engine.
- 9.4 In accordance with manufacturer's recommendations, check operation compliance of the: starter, alternator, ignition system, fuel injection system, air system, chain sensors, alternator and generator, oil pump and oil system accessories, depression pump, magnetic particle detectors, control linkages, propeller governor.
- 9.5 In accordance with manufacturer's recommendations, check compliance of the overhauled engine as specified by the manufacturer (performance, acceleration, etc.).
- 9.6 In accordance with manufacturer's recommendations, shut down the engine.
- 9.7 Determine whether the overhauled engine complies with the manufacturer's standards.

CONTENT

1. Perform a compliance test.
2. Determine the condition of the engine.
3. Record findings and recommend the actions to take.

THEME 4: Repair, Reinstallation and Adjustment, Weeks 10-14

Learning Objectives: 6.1 to 6.5, 7.1 to 7.4 and 8.1 to 8.3

- 6.1 Use protective equipment and establish a safe area around the workplace.
- 6.2 Using the overhaul manual, evaluate the possibility of repairing the engine parts.
- 6.3 Propose a repair procedure that complies with the manufacturer's recommendations.
- 6.4 Properly use the tools and equipment for repairing.
- 6.5 Check whether the repair and the part meet the manufacturer's standards.
- 7.1 Use protective equipment and establish a safe area around the workplace.
- 7.2 Proper use of specialized turbine engine assembly tools.
- 7.3 Follow the procedure described in the manufacturer's manuals for assembling a turbine engine.
- 7.4 Check quality of assembly.
- 8.1 Use protective equipment and establish a safe area around the workplace.
- 8.2 Proper use of specialized turbine engine assembly tools.
- 8.3 Follow the procedure described in the manufacturer's manuals to assemble turbine engine components.

CONTENT

- 1. Perform and/or recommend the necessary repairs
- 2. Reassemble and make adjustments
- 3. Record findings and recommend actions to take

THEME 5: ADJUSTING INSTALLED COMPONENTS (including the rigging), Week 14

Learning Objectives: 8.3

- 8.3 Follow the procedure described in the manufacturer's manuals to install turbine engine components:
 - Apply standard practices in installing components.
 - Comply with the procedure for applying torque.
 - Follow the procedure recommended by the manufacturer for installing components.
 - Adjust installed components in accordance with the manufacturer's procedure.
 - Visually inspect installed parts and components and check them for compliance.

CONTENT

- 1. Make an adjustment of the rigging components on one of the following engines: Allison 250 C20J, JT15D, PW100 et PT6A.
- 2. Record findings and recommend actions to take.

N.B: Learning Objectives: 2.3, 4.6, 5.7, 6.6, 7.5, 8.4, 9.8 and 10.1 to 10.4 apply to all laboratory courses.

Safety rules, standard operating procedures or standard general or specific inspection procedures:

2.3 Plan work to be performed (Prepare the work area):

- Make sure the work area respects the work to be performed (Safety, space, cleanliness, elevation, clarity, ventilation, etc.)
- Coordinate the availability of work help, equipment, parts and the engine to be overhauled.

4.6, 5.7, 6.6, 7.5, 8.4 and 9.8

Perform the disassembly, inspection, repair, assembly and compliance check for the parts, and components of the overhauled engine:

- Record the information in the appropriate documents:
 - Forms or electronic support.
 - Observations and operations performed.

10.1 Use necessary protective equipment (safety glasses, gloves, masks, etc.):

- Apply health and safety rules in the workplace.

10.2 Discard organic material in the appropriate place:

- Apply environmental rules regarding the work place.

10.3 Store cleaning cloths in the tray provided for this.

10.4 Make sure the area is clean.

PERSONAL STUDY ACTIVITIES

Students must complete the readings that precede each course on a weekly basis. They must also answer the formative questions asked by the instructor or used in the course notes throughout the course.

SYNTHESIS OF EVALUATION METHODS

Evaluations may be in several formats including: traditional exam format, multiple choice, laboratory report or practical diagrams.

Theory

Description of the Evaluation Activity	Context	Learning Objective(s)	Evaluation criteria	Due Date (date assignment is due or exam date)	Weighting (%)
Exam #1	Individual : Up to one hour	1.1, 1.2, 3.2, 4.3, 5.3, 6.3 and 6.5	<ul style="list-style-type: none"> • Veracity and Validity of Statements • Quality of content and completeness • See note 	Week 7	15
Exam #2	Individual : Up to two hours	7.3, 8.3 and 9.1 to 9.7	<ul style="list-style-type: none"> • Veracity and Validity of Statements • Quality of content and completeness • See note 	Weeks 14-15	15

Sub-total: 30%

Note : Evaluation criteria are given in first class.

Laboratory

Description of the Evaluation Activity	Context	Learning Objective(s)	Evaluation Criteria	Due Date (date assignment is due or exam date)	Weighting (%)
Practical Evaluation <u>Weekly</u> Disassembly	Summative Evaluation(s) (Individual and in team)	1.1 à 1.4 2.1 à 2.3 3.1 à 3.5 4.1 à 4.6 * General Points	<ul style="list-style-type: none"> • Work planning • Interpretation of documents • Compliance with instructions • Accuracy in work task • Record information See note 4 	3 to 7	40% (25% Individual) (15% In team)
Practical Evaluation <u>Weekly</u> Inspection and Assembly		5.1 à 5.6 6.1 à 6.6 7.1 à 7.4 8.1 à 8.4 * General Points		7, 8, 10 to 15	
Accurate analysis to perform a safe turbine engine functional test	Individual Summative Evaluation(s)	9.3 to 9.7	<ul style="list-style-type: none"> • Accuracy and precision 	9-11	5%
<u>Practical Evaluation</u> Perform different turbine engine functional tests	Summative Evaluation(s) Students (in team) will perform turbine engine tests in the test cell. The evaluation is individual.	9.1 to 9.7 * General Points	<ul style="list-style-type: none"> • Compliance with procedures • Compliance with instructions • Accuracy and work precision • Record information 	9-11	10%
<u>Final Exam</u>	Individual Practical Summative Evaluation(s) (up to four hours)	1.1 to 1.4 2.1, 2.2, 5.6, 9.7	<ul style="list-style-type: none"> • Interpretation of documents • Accuracy in answers • Record information • Accuracy and work 	15	15%

* General Points: For all laboratory courses: 2.3, 4.6, 5.7, 6.6, 7.5, 8.4, 9.8, 10.1 to 10.4

Sub-total: 70%
TOTAL: 100%

Note

1. The practical review evaluations will be on a weekly basis for weeks 2 to 15
2. The practical evaluations reflect individual and team work.
3. The criteria for points is based on a competency-based approach. Points are given when the work is correctly performed in compliance with applicable standards and regulations while working autonomously.

4. Evaluation criteria are given in first class.

COURSE PLAN

Week	Theory 2hr/week (15hr/session)	Week	Laboratory 4 hr/week (60 hr/session)
1-2	Course Outline Introduction to Overhauling Induction WHMIS and labels	1	Course Outline Familiarisation with engine equipment Familiarisation with engine manuals Identification of the operations to be performed
3-4	Review of Overhaul Documents Engine Model No. Laws and Regulations for Overhauls Recording operations	2	Induction (engine receipt procedure) Record all operations
5-6	General and specific standard practices: Handling, labeling and storage Removal and disassembly, repair, assembly and installation	3-5	Induction (continuation) Remove accessories Remove modules Record all operations
7	EVALUATION		
8-9	Standard inspection practices		
10-13	Compliance testing – Engine performance	6-7	Disassemble compressor module Record all operations
14-15	EVALUATION	8	Disassemble compressor module (continuation) Record all operations
		9-11	Inspect engine components Perform repairs as recommended Prepare and order parts as necessary Record all operations Perform compliance test of PT6A-28 EVALUATION
		12-13	Reassemble compressor module Record all operations
		14	Install turbine and combustion chamber modules Record all operations
		15	EVALUATION

The periods indicated for activities on the Propulsion Department course outlines are approximate. Modifications may be made due to logistical problems or situations.

MANDATORY EQUIPMENT

- ✓ Students are required to wear this safety equipment in the laboratory: safety shoes, safety glasses, labcoat or ÉNA.coveralls.
- ✓ Course Notes and appropriate manual(s).
- ✓ Rags (ENA).

MEDIAGRAPHY

Author	Title Publisher	Edition	ISBN	# of pages
Bill Fraser	CARS for the AME	5	n/a	155
Dale Hurst	Aircraft Powerplant Maintenance <i>Avotek</i>		0-9708109-3-8	423
Dale Hurst	Introduction to Aircraft Maintenance <i>Avotek</i>		0970810-62	530
Thomas Wild Ronald Sterkenburg	Aircraft Turbine Engines <i>Avotek</i>		1-933182-14-2 978-1-933189-14-7	
Dave Dueck	Aircraft regulation simplified	2	0-9697210-4-8	
FAA	Acceptable methods ac 43.13-1b/2A		0-89100-306-1	800
FAA	FAR / AMT 2007 Federal Aviation Regulations for Aircraft Maintenance Technicians <i>Jeppesen</i>		0884873145	
Kent S.Jackson Dennis G. Keith	FARs Explained - Maintenance <i>Jeppesen</i>		0-88487-322-6	500
Jeppesen	JAA ATPL, Volume 5 : Powerplant <i>Jeppesen</i>			
John Enga	Aircraft Inspection & Maintenance Records <i>Jeppesen</i>		0-88487-391-6	84
Pratt & Whitney	PT6A-21-27-28/PW100 serie/JT8D/JT15D Overhaul, Maintenance & Illustrated parts catalogs <i>Pratt & Whitney</i>		n/a	
Rolls-Royce	Allison 250 C20J/Spey/AVON/DART/RB211 Overhaul, Maintenance & Illustrated parts catalogs Rolls-Royce		n/a	
Transport Canada	Transport Canada		n/a	
W. Austyn Mair David L. Birdsall	Aircraft Performance <i>Cambridge Aerospace Series</i>		0521568366	

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. Tardiness

Students who arrive late after the beginning of the first period of a course are considered absent for this period.

3. 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.

4. 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.

5. 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 unacceptable, 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 »**.

SPECIFIC RULES FOR THIS COURSE

Course Participation

Theory

- ✓ To ensure classroom management, the teacher may issue certain requirements or prohibitions at the beginning or during the session.

Laboratory

- ✓ Students must read the assignments before the course and must also answer the formative questions asked by the instructor or use the course throughout the session.
- ✓ To ensure classroom management, the teacher may issue certain requirements or prohibitions at the beginning or during the session.
- ✓ After handling equipment, the material and manuals that were used must be clean, washed and put away; waste paper must be put in the waste basket and the work area must be clean.
- ✓ The contents of the tool boxes must be checked and put away before each class.

- ✓ Class attendance, involvement and professionalism are included in the mark for laboratory reports for each student.
- ✓ It is forbidden to eat or drink in the laboratory.

Any time the instructor considers that these conditions have not been met, he or she can take off points from the mark given for the laboratory assignment.

OTHER DEPARTMENTAL REGULATIONS

Students are encouraged to consult the website for this course:

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

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 Cégep web site at the following address: <http://ena.cegepmontpetit.ca/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: *Maintenance 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.

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.