

## **COURSE OUTLINE**

**COURSE:** **Strength of materials used in the aircraft industry**

**PROGRAM:** 280.C0 Aircraft Maintenance

**DISCIPLINE :** 280 Aeronautics

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

<u>Instructor(s)</u>	<u>Office</u>   <u>extension</u>	<u>e-mail or web site</u>
Grenier Denis	A-183 4386	<a href="mailto:denis.grenier@cegepmontpetit.ca">denis.grenier@cegepmontpetit.ca</a>
Vachon Pierre-Luc	A-183 4488	<a href="mailto:pierre-luc.vachon@cegepmontpetit.ca">pierre-luc.vachon@cegepmontpetit.ca</a>

### **OFFICE HOURS**

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Morning					
Afternoon					
Autre					

Outside of the hours of availability, it is possible to contact the instructor by using the MIO to make an appointment.

<u>Coordinator(s)</u>	<u>Office</u>   <u>extension</u>	<u>e-mail or web site</u>
Audrée Duguay-Gosselin	A-183 4392	<a href="mailto:a.duguay-gosselin@cegepmontpetit.ca">a.duguay-gosselin@cegepmontpetit.ca</a>
Stéphan Jacques	A-183 4706	<a href="mailto:stephan.jacques@cegepmontpetit.ca">stephan.jacques@cegepmontpetit.ca</a>

## **CONTEXT OF THIS COURSE IN THE PROGRAM**

This course is offered during the second session of the program. By the end of the course, students will have developed the ability to:

- Recognize materials and the manufacturing processes of aircraft components as well as their treatment and anticorrosion.
- Interpret stress tests and establish the mechanical characteristics required for the component.

This course is a co-requisite with 280-2B5-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.

**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 ».

## **COMPETENCE OF PORTRAIT OF GRADUATE**

Master the scientific bases and those of the work function.

## **MINISTERIAL OBJECTIVE(S) AND COMPETENCIES**

**025W** To perform activities related to the strength of materials used in the aircraft industry.

## **COURSE TERMINAL OBJECTIVE OF COURSE (FINAL COURSE OBJECTIVE)**

Perform activities related to the resistance of materials used in aerospace.

## **TEACHING AND LEARNING STRATEGIES**

### **Theory**

#### Teaching Methods:

Discussions and questions.

- ✦ Formal lecture.

#### Learning Activities:

Exercises.

- ✦ Work based on self study.

### **Practical Work**

#### Teaching Methods:

Short presentations of the theoretical concepts.

- ✦ Demonstrations.

#### Learning Activities:

Demonstration of heat treatment and mechanical test on strength of material. ▪ Welding exercises.

- ✦ Practical work.

Students can enhance their understanding of the material with reference books available in the library as well as specific Internet sites.

**COURSE PLAN THEORY** (course plan schedule can change)

**LEARNING OBJECTIVES**

1. Identify the main materials used in aircraft construction
2. Describe the characteristics of the main materials used in aircraft construction
3. Describe the influence of treatment on the performance of aircraft components
4. Describe the main types of heat treatment for aluminum and steel
5. Describe the influence of the manufacturing processes on the characteristics of aircraft components.
6. Describe the main types of corrosion and appropriate ways to prevent it.
7. Distinguish force, couple and moment
8. Determine the centroid and the centre of gravity of mechanical parts
9. Explain the equilibrium of simple mechanical parts and aircraft components
10. Calculate simple stresses applied to aircraft components as well as their deformation
11. Calculate the moment of inertia of simple and composite surfaces

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	1	1.1	Remote class on Teams	Coursepack and videos
2	2	2.1 to 2.2	Remote class on Teams	Coursepack and videos
3	2	2.3	Remote class on Teams	Coursepack and videos
4	3	3.1 to 3.2	Remote class on Teams	Coursepack and videos
5	4	4.1 to 4.2	Remote class on Teams	Coursepack and videos
6	5 and 6	5.1 to 5.2, 6.1	Remote class on Teams	Coursepack and videos
7	1 to 6	Exam	At school	
8	7	7.1	Remote class on Teams	Coursepack and videos
9	7	7.1	Remote class on Teams	Coursepack and videos
10	8	8.1	Remote class on Teams	Coursepack and videos
11	9	9.1	Remote class on Teams	Coursepack and videos
12	10	10.1	Remote class on Teams	Coursepack and videos
13	11	11.1 to 11.2	Remote class on Teams	Coursepack and videos
14	1 to 11	Final exam	At School	

**COURSE PLAN – THEORY**

**Activity period: Week 1**

**THEME 1: Aeronautical materials**

Learning objective	Content	Personal study activities
1.1 Identify the main materials used in aircraft construction	<ul style="list-style-type: none"> <li>▪ Physical identification and identifying by standards: steel, aluminum alloys, copper alloys, ceramics, plastic, nickel and cobalt super-alloys, wood, and composite materials</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 1.</li> <li>✦ Consult reference books</li> </ul>

**Activity period: Weeks 2 and 3**

**THEME 2: Physical, chemical and mechanical**

**properties of materials**

Learning objective	Content	Personal study activities
2.1 Describe the characteristics of the main materials used in aircraft construction.	<ul style="list-style-type: none"> <li>✦ Physical, chemical and mechanical properties.</li> <li>✦ Interpreting tables and diagrams.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 1.</li> <li>✦ Do the exercises in module 1.</li> <li>✦ Consult reference books.</li> </ul>
2.2 Describe the main mechanical tests.	<ul style="list-style-type: none"> <li>✦ Tension, hardness, impact and shearing tests.</li> <li>✦ Respect for standards.</li> <li>✦ Safety.</li> </ul>	
2.3 Interpret the experimental results and formulate a conclusion.	<ul style="list-style-type: none"> <li>▪ Effects from heat and mechanical treatment on the characteristics of aircraft components.</li> </ul>	

**Activity period: Weeks 4 and 5**

**THEME 3: Heat treatment of**

**aluminum alloys**

Learning objective	Content	Personal study activities
3.1 Describe the main types of heat treatment for some aluminum alloys.	<ul style="list-style-type: none"> <li>✦ Structural hardening, stress-relief annealing, recrystallization annealing, etc.</li> <li>✦ Respect for technical documents.</li> <li>✦ Standardized types and designation of aluminum alloys.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 2.</li> <li>✦ Do the exercises in module 2.</li> <li>✦ Consult reference books.</li> </ul>
3.2 Describe the influence of treatment on the performance of aircraft components.	<ul style="list-style-type: none"> <li>✦ Improvement of mechanical strength and ductility.</li> <li>✦ Residual stress, deformation and oxidation.</li> </ul>	

**Activity period: Weeks 5 and 6**

**THEME 4: Heat treatment for steel**

Learning objective	Content	Personal study activities
4.1 Describe the main types of heat treatment for steel.	<ul style="list-style-type: none"> <li>✦ Tempering, cooling, stress-relieving annealing, carburizing, etc.</li> <li>✦ Respect for technical documents.</li> <li>✦ Standardized types and designation of steel.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 3.</li> <li>✦ Do the exercises in Module 3.</li> <li>✦ Consult reference books.</li> </ul>
4.2 Describe the influence of heat treatment on the performance of aircraft components.	<ul style="list-style-type: none"> <li>✦ Improvement of mechanical strength and ductility.</li> <li>✦ Residual strength, deformation and oxidation.</li> </ul>	

Activity period: Week 6

THÈME 5: Manufacturing processes

Learning objective	Content	Personal study activities
5.1 Describe the influence of the manufacturing processes on the characteristics of aircraft components.	<ul style="list-style-type: none"> <li>✦ Welding, forging, chemical milling, etc.</li> <li>✦ Deformations and residual stresses of components.</li> <li>✦ Chemical, physical and mechanical alterations of materials.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 4.</li> <li>✦ Consult reference books.</li> </ul>
5.2 Determine the influence of maintenance work on the characteristics of aircraft components.	<ul style="list-style-type: none"> <li>▪ Mechanical abuse (scratches, nicks, etc.), heat abuse, machining abuse.</li> </ul>	

Activity period: Week 6

THEME 6: Corrosion and methods to control it

Learning objective	Content	Personal study activities
6.1 Describe the main types of corrosion and appropriate ways to prevent it.	<ul style="list-style-type: none"> <li>✦ General corrosion, pitting, from high temperatures, etc.</li> <li>✦ Anodising, painting, metal coating, etc.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 3.</li> <li>✦ Consult reference books.</li> </ul>

Activity period: Week 7 EXAM

Activity period: Weeks 7 and 8

THÈME 7: Forces and moments

Learning objective	Content	Personal study activities
7.1 Distinguish force, couple and moment.	<ul style="list-style-type: none"> <li>✦ Forces and vectors : definitions and characteristics.</li> <li>✦ Resultant forces. ▪ Moment of force.</li> <li>✦ Couple.</li> <li>✦ Pulleys.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 5.</li> <li>✦ Do the exercises in Module 5.</li> <li>✦ Consult reference books.</li> </ul>

Activity period: Week 9

THEME 8: Centroid and centre of gravity of a part

Learning objective	Content	Personal study activities
8.1 Determine the centroid and the centre of gravity of mechanical parts.	<ul style="list-style-type: none"> <li>✦ Difference between the centroid and the centre of gravity.</li> <li>✦ Locating the centroid and the centre of gravity.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 5.</li> <li>✦ Do the exercises in Module 5.</li> <li>✦ Consult reference books.</li> </ul>

Activity period: Week 10

THEME 9: Mechanical systems in equilibrium

Learning objective	Content	Personal study activities
9.1 Explain the equilibrium of simple mechanical parts and aircraft components.	<ul style="list-style-type: none"> <li>✦ Categorising interface support of components.</li> <li>✦ Calculating torque forces applied on simple mechanical parts and aircraft components.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 5.</li> <li>✦ Do the exercises in Module 5.</li> <li>✦ Consult reference books.</li> </ul>

**Activity period: Weeks 11 and 12    THEME 10: Calculating stresses applied    to aircraft components**

Learning objective	Content	Personal study activities
10.1 Calculate simple stresses applied to aircraft components as well as their deformation.	<ul style="list-style-type: none"> <li>✦ Simple stresses and tension from compression and shearing on the beams, on the shafts, on the tanks and on the riveted, bolted, glued and welded assemblies.</li> <li>✦ Stresses and deformations caused by twisting.</li> <li>✦ Safety factors.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 5.</li> <li>✦ Do the exercises in Module 5.</li> <li>✦ Consult reference books.</li> </ul>

**Activity period: Weeks 12, and 13    THEME 9 (continued): Calculating stresses applied to aircraft components**

Learning objective	Content	Personal study activities
11.1 Calculate the moment of inertia of simple and composite surfaces.	<ul style="list-style-type: none"> <li>✦ Moment of inertia.</li> <li>✦ Diagrams of shear forces and bending moments.</li> <li>✦ Simple and combined stresses.</li> <li>✦ Beam deflection.</li> <li>✦ Concentration of stresses.</li> <li>✦ Fatigue.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 6.</li> <li>✦ Do the exercises in Module 6.</li> <li>✦ Consult reference books.</li> </ul>
11.2 Mark out diagrams of shear forces and bending moments to calculate the stresses applied to beams, shafts, rods, etc.		

<b>Activity period: Week 14</b>	<b>FINAL EXAM</b>
---------------------------------	-------------------

## COURSE PLAN PRATICAL WORK (course plan schedule can change)

### LEARNING OBJECTIVES

1. Using mechanical tests, compare mechanical properties of the main materials used in aeronautics
2. Describe the main types of heat treatment for aluminum alloys and their influence on the mechanical properties of these metals
3. Describe anti-corrosion treatment by anodizing, Alodine, cadmium plating, etc
4. Describe the principle manufacturing process influence and maintenance work applied to aerospace components
5. Distinguish force, couple and moment of force
6. Study the equilibrium of mechanical parts according to the forces exerted on them
7. Determine stresses and deformations on aerospace components

All activities are at school

WEEK	# OBJECTIVE	CONTENT	MODE OF INSTRUCTION AND LEARNING ACTIVITIES	TECHNOLOGICAL TOOLS AND RESOURCES (URL address)
1	1	Charpy and hardness	Demonstration of:mechanical tests;	Testing machines
2	4	Welding	Welding practice	Welding machine
3	1	Tensile test	Demonstration of:mechanical tests	Testing machines
4	4	Welding	Welding practice	Welding machine
5	2	Hest treatments	Demonstration of heat treatments	Testing machines
6	4	Welding	Welding practice	Welding machine
7	3	Corrosion protection	Demonstration of process	Corosion protection machines
8	4	Welding	Welding practice	Welding machine
9	5	Forces	Practical work	
10	4	Welding	Welding practice	Welding machine
11	6	Centre of gravity	Practical work	
12	4	Welding exam		Welding machine
13	7	Test on fastener	Tensile tests and calculation	Testing machines
14	7	Equilibrium	Practical work	

## COURSE PLAN – PRACTICAL WORK

Activity Period: Weeks 1, 3, 5 and 7

Mechanical Tests, heat treatment and corrosion

Learning objective	Content	Personal study activities
1. Using mechanical tests, compare mechanical properties of the main materials used in aeronautics.	✦ Demonstration on: • hardness test; • charpy impact test; • tension test. ✦ Safety.	✦ Study: Module 1. ✦ Consult reference books.
2. Describe the main types of heat treatment for aluminum alloys and their influence on the mechanical properties of these metals.	✦ Demonstration using aluminum and steel alloy test specimens. ✦ Health and safety.	✦ Study: Modules 2 and 3. ✦ Consult reference books.
3. Describe anti-corrosion treatment by anodizing, Alodine, cadmium plating, etc.	✦ Demonstration on : • anodizing; • Alodine. ✦ Health and safety.	✦ Study: Module 3. ✦ Consult reference books.



**Activity Period: Weeks 2, 4, 6, 8, 10 and 15**

**Welding and manufacturing processes**

Learning objective	Content	Personal study activities
4. Describe the principle manufacturing process influence and maintenance work applied to aerospace components.	<ul style="list-style-type: none"> <li>✦ Demonstrate the concepts studied in the theory class</li> <li>✦ Weld joints using the GTAW (TIG) process.</li> <li>✦ Welding under gas protection with non-fusible electrodes (GTAW).</li> <li>✦ Carrying out GTAW welding on sheets and tubes.</li> <li>✦ Welding defects.</li> <li>✦ Microstructure of a welded joint.</li> <li>✦ Plasma welding and cutting.</li> <li>✦ Identification of materials.</li> <li>✦ Welding by electric resistance. ▪ ▪ Forging, Molding ▪ Lamination.</li> <li>✦ Health and safety.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 4.</li> <li>✦ Consult reference books.</li> </ul>

**Activity Period: Week 9**

**Forces and stresses**

Learning objective	Content	Personal study activities
5. Distinguish force, couple and moment of force.	<ul style="list-style-type: none"> <li>▪ Lab session accompanied by a short demonstration of forces, moments and couples.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study: Module 5.</li> <li>▪ Consult reference books.</li> </ul>

**Activity Period: Week 11**

Learning objective	Content	Personal study activities
6. Study the equilibrium of mechanical parts according to the forces exerted on them.	<ul style="list-style-type: none"> <li>▪ Lab session on centre of gravity and equilibrium equations.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study: Module 5.</li> <li>▪ Consult reference books.</li> </ul>

**Activity Period: Week 12**

Learning objective	Content	Personal study activities
7. Determine stresses and deformations on aerospace components.	<ul style="list-style-type: none"> <li>▪ Demonstration on riveted, glued and welded test samples.</li> <li>▪ Health and Safety</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study: Module 6</li> <li>▪ Consult reference books</li> </ul>

**Activity Period: Week 13**

Learning objective	Content	Personal study activities
8. Determine stresses and deformations on aerospace components.	<ul style="list-style-type: none"> <li>▪ Lab session on tensile, compression and shear stresses.</li> <li>▪ Moment of inertia</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study: Module 6.</li> <li>▪ Consult reference books.</li> </ul>

**Activity Period: Week 14**

Learning objective	Content	Personal study activities
9. Determine stresses and deformations on aerospace components.	<ul style="list-style-type: none"> <li>▪ Lab session on the calculation of stresses caused by shear force and the bending moment including a short demonstration. ▪ Safety</li> </ul>	<ul style="list-style-type: none"> <li>✦ Study: Module 5 and 6.</li> <li>✦ Consult reference books.</li> </ul>

**SYNTHESIS OF SUMMATIVE EVALUATION METHODS**

**Theory**

Description of evaluation activity	Context	Learning objective(s)	Evaluation criterias	Due date (approximate date assignment due or exam given)	Weighting (%)
Written quiz on materials and their characteristics.	Individual, remote, for up to 20 minutes.	1 and 2	1, 2, 3, 4, 6 and 7	Week 4	3%
Work on aluminum alloy and steel heat treatment.	Individual homework.	3 and 4	1, 2, 3, 4, 5, 8 and 9	Week 5	3%
Written exam on the characteristics of materials, manufacturing processes, corrosion and heat treatment.	Individual, in class, for 2 hours.	1 to 6	1, 2, 3, 4, 6, 7, 8, 9, 10 and 11	Week 7	15%
Assignment on forces, moments and couples, center of gravity and equilibrium	Individual homework.	7 to 9	1, 2, 3, 4, 5, 12, 13, 14, 15, 16 and 17	Week 10	3%
Assignment on d the equilibrium of mechanical parts.	Individual, in class, for one hour.	7 to 9	1, 2, 3, 4, 5, 12,13, 14, 15, 16 and 17	Week 12	3%
Assignment on the stresses caused by shear force, the bending moment and torsional stress.	Individual homework.	11	1, 2, 3, 4, 5, 12, 13, 14, 15, 16, 17, 18 and 19	Week 13	3%
Final written exam.	Individual, in class, for three hours.	1 to 11	All except 5	Week 14	30%

**Sub-total : 60% Évaluation criterias**

1. Clarity and precision of answers;
2. Appropriate justification of the answers;
3. Conformity of the units;
4. Conformity of the technical terms;
5. Respect of the rules of presentation. For example, tables, charts, etc.
6. Proper application of physical, chemical and mechanical properties;
7. Precise calculation of the mechanical properties obtained by means of mechanical tests;
8. Fair description of the main heat treatments of aluminum alloys and their influence on the performance of aircraft components;
9. Appropriate description of the main heat treatments and the main surface treatments of steels and their influence on the performances of the components of aircraft;
10. Appropriate description of manufacturing processes and their influence on the performance of aircraft components;
11. Appropriate description of the influence of corrosion on the performance of aircraft components;
12. Precise calculation of the forces and their resultant;
13. Appropriate application of equilibrium equations;
14. Precise calculation of the moments;
15. Precise calculation of the center of gravity while indicating its exact position on the component;
16. Precise establishment of the FBD
17. Precise calculation of the reactions on the different components of any mechanism;
18. Precise calculation of the moment of inertia;
19. Correct calculation of the mechanical stresses due to the shearing force and the bending moment as well as the deformations which follow it.

Practice

Mechanical Tests, Heat Treatment and Corrosion

Description of evaluation activity	Context	Learning objective(s)	Evaluation criterias	Due date (approximate date assignment due or exam given)	Weighting (%)
† Hardness tests and Charpy. † Questionnaire.	Demonstration using the machine for tensile testing, hardness, charpy impact and using test samples.	1	1, 2, 3, 4, 5 and 6	Week 2	3%
▪ Tensile test	Demonstration using the machine for tensile testing, hardness, charpy impact and using test samples	1	1, 2, 3, 4, 5 and 6	Week 4	3%
† Aluminum alloy and steel heat treatment. † Questionnaire.	Demonstration using a furnace, a hardening bath and test samples.	2	1, 2, 3, 4, 5, 6, 7 and 8	Week 6	3%
† Treat for corrosion (anodizing). † Questionnaire.	Demonstration using chemical solutions and a source of electrical current.	3	1, 2, 3, 4, 6 and 9	Week 8	3%

Evaluation criterias

1. Appropriate justification of the answers;
2. Conforming application of units;
3. Consistent application of technical terms;
4. Respect of the rules of presentation. For example, tables, charts, mediagraphy, etc.
5. Precise calculation of mechanical properties obtained by mechanical tests;
6. Appropriate analysis of the results;
7. Description of the main heat treatments of aluminum alloys and their influence on the performance of aircraft components;
8. Fair description of the main heat treatments and surface treatments of steels and their influence on the performance of aircraft components;
9. Correct choice of means to fight against corrosion and influence of corrosion on the performance of aircraft components

Welding and Manufacturing Processes

<b>Description of evaluation activity</b>	<b>Context</b>	<b>Learning objective(s)</b>	<b>Evaluation criterias</b>	<b>Due date (approximate date assignment due or exam given)</b>	<b>Weighting (%)</b>
Work related to parameters for carrying out a GTAW (TIG) joint welding.	Individual homework.	1	1 to 5	Week 5	4%
Practical exam on the execution of a GTAW (TIG) joint welding.	Individual, in the laboratory, for up to one hour.	1	4, 6	Week 15	7%
Practical exam on the manufacturing processes and identification of materials.	Individual, in the laboratory, for up to 30 minutes.	All	2, 7, 8 and 11	Week 15	4%

Evaluation criterias

1. Conforming application of units;
2. Consistent application of technical terms;
3. Respect of the rules of presentation. For example, tables, charts, mediagraphy, etc.
4. Judicious choice of parameters to avoid weld defects;
5. Proper description of the TIG welding procedure;
6. Proper execution of the weld to avoid welding defects;
7. Fair identification of materials according to their physical and mechanical properties;
8. Fair identification of manufacturing processes according to the function of the aircraft components;
9. Just description of welding processes;
10. Relevant interpretation of welding parameters;
11. Clarity and precision of answers

Forces and Stresses

<b>Description of evaluation activity</b>	<b>Context</b>	<b>Learning objective(s)</b>	<b>Evaluation Criteria's*</b>	<b>Due date (approximate date assignment due or exam given)</b>	<b>Weighting (%)</b>
Lab session on forces, moments and couples.	Individual, in class.	1	1 to 6	Week 9	3%
Lab session on the centre of gravity and equilibrium of mechanical pieces.	Individual, in class.	2	1 to 10	Week 11	3%
✦ Shearing test. ✦ Writing a report.	Demonstration and basic concepts.	3	1, 2, 6 and 12	Week 13	4%

**Course Outline 280-2C5-EM: Strength of materials used in the aircraft industry**

Lab session on simple stresses applied to individual mechanical parts and. on the moment of inertia, the bending moment, shearing strain and stresses.	Individual, in class.	4	1 to 11	Week 14	3%
--	-----------------------	---	---------	---------	----

**Evaluation criterias**

1. Conforming application of units;
2. Consistent application of technical terms;
3. Respect of the rules of presentation. For example, tables, charts, etc.
4. Just calculation of the forces and their resultant
5. Accurate calculation of moments;
6. Results analysis;
7. Correct calculation of the center of gravity while indicating its exact position on the component;
8. Precise establishment of the FBD;
9. Just application of equilibrium equations;
10. Just calculation of the reactions on the different components of any mechanism;
11. Proper calculation of the moment of inertia;
12. Precise calculation of shear stresses;
13. Respect of the rules of presentation. For example, tables, charts, mediagraphy, etc.
14. Correct calculation of the mechanical stresses due to the shear and the bending moment as well as the deformations that follow

**Sub-total : 40%**

**TOTAL : 100%**

**REQUIRED MATERIAL**

Coursepack # 5628; scientific calculator; ruler; graph paper; protractor; safety glasses; overalls.

**MEDIAGRAPHY**

Bouchy, Godin. *Métallurgie*, Armand Collin, Paris.

Côté, Michèle. *Résistance de matériaux CCDMD*, les éditions "Le Griffon d'argile".

Dell K., Allen. *Metallurgy Theory and Practice*, American Technical Society. E. Paul de Garno.

*Materials and Processes in Manufacturing*, McMillan Co.

Frier. *Elementary Metallurgy*, McGraw-Hill.

Hilly & Chaisson. *Cours de métallurgie*, Dunod, Paris.

Lignon J. & M. Nijon. *Matériaux, propriétés, traitements normalisation*, Delagrave, Paris.

Levinson, I.J. *Mechanics of Materials*, Prentice-Hall.

Meriam, J.L. *Engineering Mechanics : volume 1, Statics*, Wiley.

Sacks, Raymond J. & Edward R. Bohnart, *Welding Principles and Practices*, McGraw-Hill.

## **REQUIREMENTS TO PASS THE COURSE 1. Passing Mark**

The student must meet the following requirements to succeed: obtain a minimum of 60% at the theoretical evaluation; obtain a minimum of 60% for practical evaluation;

Failing to meet these requirements, the student obtains, in his bulletin, the lowest note recorded: that of the theoretical evaluation or that of the practical evaluation of 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](http://www.cegepmontpetit.ca/normes) under the heading **Liens éclair, Bibliothèques, « Méthodologie »**.

## **METHODS OF COURSE PARTICIPATION**

Using the equipment, machines and the Department laboratories outside of class hours is strictly forbidden unless an agreement has been made with the Department coordinator.

Appropriate clothing, safety glasses and safety shoes or boots must be worn in the workshops. For safety and security reasons, sandals, shorts and any other inappropriate clothing will not be permitted.

Students whose behavior creates a risk for other people will receive a warning from the teacher; if there is no change then they will be excluded from the laboratory until the situation is reviewed by the instructor and the Coordinator of the Aircraft Techniques de génie aérospatial Department.

Students who do not comply with the rules taught in class regarding the proper usage and maintenance of tools and equipment may be suspended from the course until the situation can be reviewed by the teacher and the Department coordinator.

### **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.

## ***Course Outline 280-2C5-EM: Strength of materials used in the aircraft industry***

For pedagogical reasons, some courses may be recorded. It is the teacher's responsibility 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 Cégep's Secretary General's Office.

### **OTHER DEPARTMENTAL REGULATIONS**

Students are encouraged to consult the website for the specific regulations 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, Conditions d'admission et de cheminement scolaire, Politique relative à l'usage, à la qualité et à la valorisation de la langue française, Politique pour un milieu d'études et de travail exempt de harcèlement et de violence, Procédures 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://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.

### **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](mailto: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.

### **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.