

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY
SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: Applied Mechanics

CODE NO. : MCH 110 SEMESTER: One

PROGRAM: Aviation Technology

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APPROVED

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COURSE NAME
APPLIED MECHANICS

CODE NO
MCH 110

TOTAL CREDIT HOURS: Three (3)

PREREQUISITE(S): None

I. PHILOSOPHY/GOALS:

This course provides the student of Aviation Technology the opportunity to explore and apply the principles of mechanics as a basis for the other courses in the Aviation Technology program. The course includes a refresher in mathematics, systems of units, and cross conversions.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon completion of this course the student will be able to:

1. Recall and apply the mathematics of the trigonometry of the right triangle.
2. Use the three fundamental units and their derivations.
3. Use dimension analysis where required for conversion of units.
4. Resolve and add vector qualities to determine resultants and equilibrants.
5. Understand the concept of moments and couples, and calculate the moment of a force about a point.
6. Sketch free body diagrams and apply the three conditions of equilibrium to f.b.d.'s of coplanar systems.
7. Use method of joints, sections and Bow's notation to determine internal loads on various configurated structural members.
8. Understand and apply the laws of friction to situations involving friction and normal forces.
9. Determine the centroid of simple and complex areas.

III. TOPICS TO BE COVERED

APPROXIMATE HOURS

1. Introduction	8
Mathematics of Mechanics	
Conversion of Units	
2. Vector Analysis	12
Forces, Vectors, and Resultants	
3. Equilibrium	12
Two-Dimensional Forces Systems	
Forces in Space	

<u>III. TOPICS TO BE COVERED (cont'd.)</u>	<u>APPROXIMATE HOURS</u>
4. Structures and Members Force Analysis of Structures Method of Section and Bow's Notation	12
5. Friction Laws and Angle of Friction	8
6. Centre of Gravity Determination of the Centroid of an Area	8

IV. LEARNING ACTIVITIES

1.0 MATHEMATICS AND UNITS OF APPLIED MECHANICS

Upon completion of this unit the student will be able to:

- 1.1 Recall the simple trigonometric ratios and apply to solve unknown parts of rights triangles.
- 1.2 Recall the Sine and Cosine Laws for the solution of unknowns in any triangle.
- 1.3 Recall relationships between units in both S.I. (Systeme Internationale) and I.S. (Imperial System) units and make conversions between the two systems.
- 1.4 Solve the unknowns using appropriate trigonometric relationships in problems 1-6, 1-7, 1-9, 1-10, 1-11, 1-12, 1-13, 1-14, 1-16, 1-17, 1-19, 1-21, 1-23, 1-25, 1-27.

REQUIRED RESOURCES FOR 1.0:

Textbook Applied Mechanics for Engineering Technology, pages 1-26.

IV. LEARNING ACTIVITIES

2.0 FORCES, VECTORS, RESULTANTS. AND MOMENTS

Upon completion this unit the student will be able to:

- 2.1 Determine the resultant of two vectors at right angles to each other by drawing a vector triangle and using the simple trig functions to solve.
- 2.2 Determine the resultant of any two vectors by drawing the vector triangle (vector diagram) and using either Sine or Cosine Law.
- 2.3 Resolve any vector quantity into horizontal and Vertical components and determine the resultant by the addition of components.
- 2.4 Resolve any vector quantity into components along any two axes and determine the resultants by component addition.
- 2.5 Determine the moment of a force.
- 2.6 Replace a given couple with an equivalent couple in another location.
- 2.7 Solve for unknowns as required in problems 2-1, 2-2, 2-3, 2-5, 2-7, 2-9, 2-11, 2-12, 2-15, 2-19, 2-21, 2-23, 2-27, 2-29, 2-31, 2-33, 3-1, 3-3, 3-5, 3-7, 3-9, 3-11, 3-13, 3-15, 3-17, 3-19, 3-21, 3-23.
- 2.8 Perform Lab A.M. 1.

REQUIRED RESOURCES FOR 2.0:

Applied Mechanics for Engineering Technology, Chapter 2, pp. 27-49; Chapter 3, pp. 50-67.

Lab A.M. 1.

IV. LEARNING ACTIVITIES

3.0 EQUILIBRIUM

Upon completion of this unit the student will be able to:

- 3.1 Draw a complete free-body diagram (fbd) of part or whole mechanisms.
- 3.2 Apply the three conditions of equilibrium to fbd's of coplanar systems.

3.0 EQUILIBRIUM (cont'd.)

- 3.3 Memorize and apply the directional conventions of the laws of equilibrium 6
- 3.4 Apply the principles of equilibrium to the solution of problems involving pulleys.
- 3.5 Apply the principles of equilibrium to the solution of problems involving coplanar concurrent force systems.
- 3.6 Apply the principles of equilibrium to the solution of problems involving coplanar parallel force systems.
- 3.7 Apply the principles of equilibrium to the solution of problems involving coplanar non-concurrent force systems.
- 3.8 Solve the unknowns as required in problems 4-1, 4-3, 4-5, 4-7, 4-9, 4-11, 4-13, 4-15, 4-17, 4-19, 4-21, 4-23, 4-24, 4-25, 4-27, 4-29, 4-31, 4-33, 4-35, 4-37, 4-39, 4-40, 4-41, 4-43, 4-45, 4-47, 4-49, 4-51, 4-53, 4-55, 4-57, 4-59, 4-61, 4-63, 4-67, 4-69, 4-71.

REQUIRED RESOURCES FOR 3.0:

Applied Mechanics for Engineering Technology, Chapter 4, pp. 68-116.

IV. LEARNING ACTIVITIES

4.0 STRUCTURES AND MEMBERS

Upon completion of this unit the student will be able to:

- 4.1 Recall and apply previous knowledge of coplanar concurrent force systems.
- 4.2 Determine the loads in individual members of a pin-connected truss by the method of joints.
- 4.3 Calculate truss loads by the method of sections using a fbd of a partial truss.
- 4.4 Calculate loads and internal reactions by Bow's Notation method.

4.0 STRUCTURES AND MEMBERS (cont'd.)

- 4.5 Solve the required unknowns in problems 5-1, 5-2, 5-3, 5-5, 5-7, 5-9, 5-11, 5-13, 5-15, 5-17, 5-19, 5-21, 5-23, 5-25, 5-27, 5-29, 5-31, 5-33, 5-35, 5-37, 5-39, 5-41, 5-43, 5-45, 5-47, 5-49, 5-51, 5-53, 5-55, 5-57, 5-59, 5-61, 5-63.

REQUIRED RESOURCES FOR 4.0:

Applied Mechanics for Engineering Technology, pp. 117-165.

IV. LEARNING ACTIVITIES

5.0 FRICITION

Upon completion of this unit the student will be able to:

- 5.1 Apply the laws of friction for dry surfaces to both flat surfaces and flat belts.
- 5.2 Determine if motion is pending.
- 5.3 Determine whether tipping or sliding will occur.
- 5.4 Determine the unknown quantities in the following problem situations: 7-1, 7-3, 7-5, 7-7, 7-9, 7-11, 7-13, 7-15, 7-17, 7-19, 7-21, 7-23, 7-25, 7-27, 7-29, 7-31, 7-33, 7-35, 7-37, 7-38, 7-40, 7-41, 7-43, 7-45, 7-47, 7-50, 7-51.

REQUIRED RESOURCES FOR 5.0:

Applied Mechanics for Engineering Technology, pp. 202-233.

IV. LEARNING ACTIVITIES

6.0 CENTROIDS AND CENTRE OF GRAVITY

Upon completion of this unit the student will be able to:

- 6.1 Determine the location of centroids of simple areas.
- 6.2 Determine the location of the centroid of a composite area by breaking it into several simple areas.
- 6.3 Determine the centroid of lines using a method similar to that of 6.2.

6.0 CENTROIDS AND CENTRE OF GRAVITY (cont'd.)

6.4 Solve for the requested unknown in the following problems:
8-1, 8-3, 8-5, 8-7, 8-9, 8-11, 8-13, 8-15, 8-17, 8-19, 8-20.

REQUIRED RESOURCES FOR 6.0:

Applied Mechanics for Engineering Technology.

V. EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.)

Although attendance records will not have a direct influence on your grades, you are encouraged to attend all theory classes.

There will be three major tests given one week after the test is announced.

Test #1 - Units 1, 2
Test #2 - Units 3, 4
Test #3 - Units 5, 6

As part of the learning activities for each topic there are problems and labs to complete. In this activity the student is encouraged to use all available resources in a team situation to solve several problems. Marks up to 30% of a topic worth are assigned for problems lab work.

Numerical marks relate to grades according to the schedule below:

A+_____90-100%

A_____80-89%

B_____70-79%

C_____60-69%

X & R_____less than 60%

Rewrites

No rewrites will be provided on topical tests.

VI. REQUIRED RESOURCES

Textbook:

Walker, Applied Mechanics for Engineering Technology.
Fourth edition, Prentice Hall.

VII. ADDITIONAL RESOURCE MATERIALS

None required.

VIII. SPECIAL NOTES

Your instructor reserves the right to modify the course as he deems necessary to meet the needs of the students.