SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title:	APPLIED MECHANICS
Code No,:	MCH **0**
Program:	AVIATION
Semester:	ONE
Date:	APRIL 1988
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New X Revision

APPROVED;

Chairperson Date

CALENDAR DESCRIPTION

APPLIED MECHANICS	MCH
Course Name	Course Number

PHILOSOPHY/GOALS;

In attempting to understand the nature of things around us there is probably no science more basic than mechanics. The student of engineering could not begin to design/construct a building, bridge or automobile without some prior analysis based on the principles of mechanics. As the title would imply, a concentrated effort is put forth to make the course as practical and realistic as possible.

METHOD OF ASSESSMENT (GRADING METHOD):

See attached sheet

TEXTBOOK(S):

Introduction to Mechanics - Levinson

APPLIED MECHANICS

This course will cover chapters 1 to 6 inclusive, in "Introduction to Mechanics" by Levinson.

Classes will be conducted combining lectures, demonstrations and labs.

You will be tested on chapters 1 and 2, two weeks after completion of these chapters.

You will be tested on chapters 3 and 4, two weeks after completion of these chapters•

The final test will be administered after completion of chapter 6.

Tests will be announced one week in advance,

ALL students are expected to complete assignments on time, be punctual and regular attenders.

GRADES:
"A" - consistently above average
"B" - above average
"C" - average

APPLIED MECHANICS

TOPIC NO	PERIODS	TOPIC
		INTRODUCTION
		Basic Trig. Functions Conversion of Units
	10	FORCE SYSTEMS
		Characteristics and units of force Vector and scalar quantities Components of a force Resultant of parallel forces Moment of a force Principle of moments Couples
		CENTROID and CENTRE OF GRAVITY
		Determination of centroid Determination of centre of gravity Centre of gravity of simple and composite solid
		EQUILIBRIUM
		Equilibrium of two dimensional sytems Equilibrium of force systems Beam reactions
		FRAMES/STRUCTURES
		Tension members Compression members Pin Connected Joints Method of Sections Graphical Method - Optional

APPLIED MECHANICS

Unit # 1 - Mathematics of Mechanics

GENERAL OBJECTIVE:

The student will be able to solve a number of varied problems dealing with the Mathematics of Mechanics.

SPECIFIC OBJECTIVES:

1. To be able to define the term sine of an angle in a right-angled triangle.

2. To be able to define the term cosine of an angle in a right-angled triangle.

3. To be able to define the term tangent of an angle in a right-angled triangle.

4. To be able to state the Sine Law for any triangle.

5- To be able to state the Cosine Law for any triangle.

6. To be able to convert physical quantities of length, time and weight: eg: inches to feet, feet to yards, seconds to minutes, pounds to tons, etc.

7. Using the calculator and the above specific objectives, the student wil solve correctly the following problems in the textbook: Qu. 1-5, 7, 8, 16, 17, 20, 21, 22, 24, 27 and 29.

Unit # 2 - Forces

GENERAL OBJECTIVE:

The student will be able to solve a number of varied problems dealing with the characteristics of forces, moments and couples.

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Unit # 2 continued . . . . .

SPECIFIC OBJECTIVES:

1. a) To be able to state Newton's First Law of Force,
   b) To be able to state Newton's Second Law of Force,
   c) To be able to state Newton's Third Law of Force.

2. a) To be able to define the Magnitude of a Force.
   b) To be able to define the Direction of a Force.
   c) To be able to define the Line of Action of a force,

3. To be able to state the meaning of the principle of the transmissibility of a force.

4. To be able to define the term scalar quantity,

5. To be able to define the term vector quantity.

6. To be able to distinguish between vector and scalar quantities,

7. To be able to add vectors graphically using the String Polygon Method by drawing the vectors accurately to scale and in the proper direction.

8. To be able to define the term Resultant of vector addition.

9. To be able to resolve a force into horizontal and vertical components.

10. a) To be able to add algebraically horizontal components using a rectangular coordinate system.

    b) To be able to add algebraically vertical components using a rectangular corrdinate system.

11. To be able to determine the resultant in magnitude of the algebraic vector sum of vertical and horizontal components.

12. To be able to determine the direction of the resultant in of the algebraic vector sum of vertical and horizontal components.

13. To be able to define the term magnitude of the Moment of Force.

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Unit # 2 continued . . . . .

14. To be able to state the theorem of statics: the moment of a force is equal to the sum of the moments of the components of that force,

15. a) To be able to calculate the magnitude of the resultant of a force system by algebraic addition.

    b) To be able to determine the location of the resultant of a force system using the Principle of Moments.

16. To be able to define the term couple.

17. To be able to calculate the magnitude and direction of a couple.

18. a) To be able to calculate the magnitude of the resultant of a three dimensional force system, using direction cosines.

    b) To be able to calculate the direction of the resultant of a three dimensional force system, using direction cosines.

19. Using graphical means, the student will accurately construct a string polygon to solve for the resultant force in each of the following problems: - 2-10, 11, 12, 34 and 35.

20. Using the calculator the student will solve correctly the following problems by means of algebraic horizontal and vertical vector component addition: - 2-11, 12, 15, 19, 33, 34, 35, 36 and 37.

21. Using the calculator, algebraic vector component addition and the principle of moments, the student will solve correctly the following problems: - 2-53, 54, 55, 56, 57 and 58.

22. Using the calculator and specific objectives 16 and 17, the student will solve correctly the following problems: 2-62, 63 and 66.

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Unit # 2 continued ....

23. Using the calculator specific objectives, the student will solve correc the following problems: - 2-43, 44, 45 and 46.

Unit # 3 - Centre of Gravity and Centroids of Section

GENERAL OBJECTIVE:

The student will be able to ascertain both mathematically and experimentally the location of the centre of gravity of mass and the centroid of area.

SPECIFIC OBJECTIVES:

1. To be able to determine the centre of gravity of mass experimentally by suspending the object from various points.

2. To be able to calculate, using the principles of resultants and moments, the centre of gravity of grouped particles.

3. To be able to calculate, using the principles of resultants and moments, the centroid of any homogeneous plane figure.

4. To be able to recall the formulae for the centroidal location of the centroids of a rectangle, circle, triangle, and semicircle.

5. To be able to calculate the centroidal location of areas using the formulae from specific objective 4,

6. To be able to ascertain from properties of Structural Shape Tables the centroid of Standard Shapes.

7. Using the above objectives, the student will be able to solve correctly t following problems in the textbook: - 3-1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15, 16, 17 and 18.

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Unit # 4 - Equilibrium

GENERAL OBJECTIVE:

The student will be able to calculate the forces, moments or couples require to maintain equilibrium in any two-dimensional force system.

SPECIFIC OBJECTIVES:

1. To be able to define the term equilibrium.

2. a) To be able to state the equation of Horizontal equilibrium.

   b) To be able to state the equation of Vertical equilibrium.

   c) To be able to state the equation of Moment equilibrium.

3. To be able to define the expression "free-body diagram".

4. To be able to draw a "free-body diagram".

5. To be able to recall the method of determination of the resultant of a force system.

6. To be able to balance a resultant force to give a condition of equilibriu in a force system.

7. To be able to balance a resultant moment to give a condition of equilibrium in a force system.

8. a) To be able to define the term collinear force system.

   b) To be able to define the term concurrent force system.

   c) To be able to define the term parallel force system.

9. To be able to define the term equilibrant.

10. Using the above specific objectives, the student will solve correctly the following problems: 4-10, 11, 12, 15, 16, 17, 18, 20, 23, 24, 25, 26, 28 36, 37 and 38.

Unit # 5 - Frames/Structures

GENERAL OBJECTIVE:

The student will be able to solve a variety of problems dealing with frames carrying external loads.

SPECIFIC OBJECTIVES:

1. To be able to recall the 3 equations of equilibrium.
2. To be able to recall the method of free-body diagram construction.
3. To be able to define the term structure.
4. To be able to recall the definition of the terms tension and compression
5. To be able to recall the definition for the term reaction.
6. To be able to identify members that carry "no load" in a frame.
7. To be able to recall method for calculating reactions.
8. To be able to apply the equations of Equilibrium.
9. To be able to calculate the forces in the members that are cut through for free body diagram.
10, To be able to determine the nature of the force in the member i.e. tension/compression.
11. To be able to calculate a number of assigned problems using a calculator and the above objectives.