#82

COURSE OUTLINE

Course Title: APPLIED MECHANICS

Code No.: MCH 100-3 (formerly ARC 100)

Program: ARCHITECTURAL ENGINEERING - 1 & CIVIL/CONST. TECH.

Semester: FIRST

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New:_____ Revision: X

APPROVED: K P Chaplin 89/08/23
Chairperson Date

APPLIED MECHANICS MCH 100-3

PHILOSOPHY/GOALS:

It is important for the student in an Engineering Course to have an understanding of the basic principles of mechanics. The course is designed, as the name indicates, from a practical point of view. Problems are founded on everyday examples and solutions are encouraged based on an analysis and the application of fundamental laws.

METHOD OF ASSESSMENT:

- See Attached Sheet -

TEXTBOOK: Introduction to Mechanics - I. J. Levinson

APPLIED MECHANICS

CIVIL & ARCHITECTURAL TECHNICIAN CLASS

Course Information

1. The course outline and objectives are available for student perusal.

2. Classes will be conducted combining lecture, demonstration and labs.

3. A final grade will be awarded based on the average of tests given during the semester.

4. In the event a student has two or more "I" grades and an average mark below 60% he/she will be required to write a final examination. The results of this final will result in either a "C" grade or an "R".

5. Grades: A - 85% + = Consistently outstanding achievement
   B - 70% + = Consistently above average achievement
   C - 55% + = Average or acceptable achievement

6. Tests will be announced one week in advance.

7. All students are expected to complete assignments on time, and be punctual, regular attendants.

Instructor: Mr. N. Triplett

Topic No.	Periods	Topic Description	Reference
1	6	Introduction	
		Mathematics of mechanics Conversion of units.	
2	15	Forces	
		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	
3	6	Equilibrium	
		Equilibrant of force system Equilibrium of two dimensional systems Beam reactions	
4	6	Centroid and Centre of Gravity	
		Determination of centroid Determination of centre of gravity Centre of gravity of simple and composite solids.	
5	12	Structures	
		Simple trusses and frames Bow's notation Tensile and compressive forces Method of sections Combined diagrams	

Course is based on two periods of theory and one period of lab.

APPLIED MECHANICS - MCH100-3

Course Textbook - Introduction to Mechanics - Levinson

Unit #1 - Mathematics of Mechanics

General Objective

The student will be able to solve a number of various 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 will solve correctly the following problems in the textbook, Questions 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.

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 co-ordinate system.

    b) To be able to add algebraically vertical components using a rectangular co-ordinate 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 of the algebraic vector sum of vertical and horizontal components.

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

14. To be able to state the theorem of states: 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. To be able to define the term direction cosine in a three dimensional force system.

19. To be able to add direction cosines algebraically.

20. 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.

21. 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.

22. 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.

23. 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.

24. Using the calculator and specific objectives 16 and 17, the student will solve correctly the following problems: 2-43, 44, 45, and 46.

25. Using the calculator and specific objectives 18, 19, and 20, the student will solve correctly the following problems: 2-43, 44, 45, and 46.

Unit #3 - Equilibrium

General Objectives

The student will be able to calculate the forces, moments or couples required 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 equilibrium 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 calculator and 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 #4 - Centre of Gravity and Centroids of Section

General Objective

The student will be to ascertain both mathematically and experimentally the location of the certre 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 semi-circle.

5. To be able to calculate the centroidal location of areas using the formulae from S.O.4.

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

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

Unit #5 - Force Analysis of Structures

General Objective

The student will be able to determine by means of force analysis the nature and magnitude of forces in a structure using the Method of Sections and graphical solution.

Specific Objectives

1. To be able to define the term structure.
2. To be able to define the term simple truss.
3. To be able to recall the three equations of equilibrium.
4. To be able to define the term pinned joint.
5. a) To be able to define the term tension.
   b) To be able to define the term compression.
6. To be able to identify internal forces in the members.
7. To be able to recall a free-body diagram.
8. To be able to recall the calculation of support reactions.
9. To be able to cut through the structural members in which the required forces are to be found.
10. To be able to replace internal forces by externally applied forces.
11. To be able to select the points about which moments should be taken.
12. a) To be able to apply the equation V = O.
    b) To be able to apply the equation H = O in order to check the solutions.
13. Using the calculator and the above specific objectives, the student will be able to correctly solve the following problems: 5-3, 5, 14, 16, 17, 18 and 19.
14. To be able to draw accurately to scale the loaded structural frame.
15. To be able to apply Bows' Notation to the loaded structural frame (Space Diagram).
16. To be able to construct accurately to scale the external force diagram.

17. To be able to construct accurately to scale the internal force diagram.

18. a) To be able to determine accurately the magnitude of the internal forces by measurement from the internal force diagram.
    b) To be able to determine the nature of the internal forces from the space and internal force diagrams.

19. Using graphical means, the student will accurately construct the space, external force and internal force diagrams to solve the following problems: 5-3, 4, 5, 6, 17 and 19.