SAULT COLLEGE OP APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: APPLim MECHANICS

No.: MCH 110

Program: MFCHANTCAr

Semester: ONE

Date: DECEMBER 1986

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New: Revision:

APPROVED: !/* Chairperson Date

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CAIFNDAR DESCRIPTION

APPLIED MECHANICS | MCH 110
Course Name | Course Number

PHILOSOPHY/GOALS:

This course is the first basic course in the Mechanical Programs. A sound knowledge of it is required to progress to advanced levels. It is therefore required that the student apply himself/herself diligently to th< work required for successful completion.

METHOD OF ASSESSMENT (GRADING METHOD):

See attached sheet

TEXTBOOK(S):

Introduction to Mechanics - T.evinson

APPLIED MECHANICS

MCH 110

This course will covor chapters 1 to 6 inclusive, in "Introduction to Meehinics" by T.ovinson.

Cla- : s wil1 bo coniiucted 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

MCH 110

PERIODS	TOPIC
8	INTRODUCTION
	Mathematics of Mechanics Conversion of Units
1 2	FORCE SYSTEMS
	Forres Vectors Veeror A◁◁itinn Resu1 rants Moments ami Couples
8	CENTRE OF GRAVITY
	Determination of Centre of Gravity Centroids
12	EQUILIBRIUM
	Equilibrium of two dimensional Fore Systems Equilibrium of Forces in Space
12	FORCE ANALYSIS OF STRUCTURES
	Simple Trusses Analysis by Method of Sections Analysis by Bow's Notation
8	FRICTION
	Laws of Friction Anqle of Friction Analysis by Equation of Equilibrium

APPLIED MECHANICS

MCH 110

Unit # 1 - Mathematics of Mechanics

GENERAL OBJECTIVE:

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

SPECIFIC OBJECTIVES;

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

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 tri ma le.

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 ton etc.

7. Us inq the above specific objectives, the student will solve correctly following problems i n the textbook: Qu. 1-5, 7, 8, 16, 17, 20, 21, 2 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.

Applied Mechanics - MCH 110

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 transmissibilit of a force.

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

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

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

7. To be able to add vectors graphically using thp String Polygon Method by drawing the vectors ac••urate! y to soil e and in the proper direction,

8. To we able to d~r i 'v ' ->rm Resul * a tit of vertor addition.

9. To he Vole to resolve a foro^ into horizontal nn^ verth-il components.

10. a) To be able to add al-.johr- i i c^ 1 }•' • i^ont.^l components using a rectangular coordinate syc torn .

    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.

Applied Mechanics - MCH 110

Unit # 2 continued .....

14. To be ahlo ho ^tate the theorem of statics: the moment of a force is equal to the sum of the moments of the e^nrrnonts of that force.

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

    b) To be able to determine t-he 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 th^ resultant force in each of the following problems: - 2-10, 1L, \2, 34 and 35.

22. 'T- i -.'i t-he calculator the student will solve correctly the following problems by m ans of alger t aic h :r i v..->nt il and vertical vector componen addition: - 2-11, 12, 15, 19, 33, 34, JD, 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: 2-62, 63 and 66.

Applied Mechanics - MCH 110

Unit # 2 continued . . . . .

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

Unit # 3 - CPPhre of Gravity and Centroids of Section

GENERAL 0BJECTIVE:

The st-uddiL will be able to ascertain both mathematically and experimental1 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 usinq 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 following problems in the t-^vtbon^: : - 1- 1 , ["> , 3, 4, 5, 6r 10, 11, 12, 1 14, 15, 16, 17 and 1R.

Applied Mechanics - MCH 110

Unit # 4 - Equilibrium

GENERAL OBJECTIVE;

The student will be able to calculate the forces, moments or couples requir
to m intain . juilibrium in any hwo-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 qive a condition of eq.uilibr in a force system.

7. To be able to balance a resultant moment to give a condition of equilibrium in *a* r^r-^ system.

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

   b) To be able to =". ;' i no the t-^ rm concurrent- force system.

   c) To be abltj to d-Hne t-he term parallel force svstem.

9. To be able to define thr- f-^rm equi 1 ibr . < .

10. Using the above specific -Hves, the student will solve correctly t following problems: -i-i1', ;:, 1r-, 16, 17, IP, 20, 23, 24, 25, 26, 36, 37 and 38.

Unit # 5 - Force Analysis of Structures

GENERAL OBJECTIVE:

The student will be able to determine by means of force analysis, the natur 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 *-h.-> term simple truss.
3. To be able to define the three equations of equ>1ibrium.
4. To be able to define the term pinned i~int.
5. a) To be able to define t-he term tension.
   b) To be able to define Hie t-^rm 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 0 in order to check the solutions.
13. Using drafting equipment to draw, accurately to scale, the loaded structural frame.
14. Using the calculator and the above specific objectives to be able to correctly solve the following problems: 5-3, 5, 14, 16, 17, 18 and 19.
15. To be able to apply Bov^? Motation to the Loaded structural frame.
16. To be able *to* construct accurately to scale the internal 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.

Applied Mechanics - MCH 110

Unit # 6 - Friction

GENERAL OBJECTIVE;

The student will be able to solve a variety of problems dealing with fricti

SPEC!FTC_ OBJECTIVES:

1. To *be* able to *rvra*11 the three equations of equilibrium.

2. To be able to recall the method of free-body diagram construction.

3. To be able to state the three laws of friction.

4. a) To be able to define the term Static Friction,
   b) To be able to define the term Kinetic Friction.

5. a) To be able to apply the static friction force formula,
   b) To be able to apply the kinetic friction force formula.

6. To be able to define the term co-efficient of friction.

7. To be able to define the term Normal Force.

8. To be able to define the term Angle of Friction.

9. To be able to explain the relationship between the angle of friction and the co-eff icient of friction.

10. Using the above objectives, the student will solve correctly, the folio problems: 6-4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17 and 18.