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SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: ARCHITECTURAL ENGINEERING

Code No.: ARC 235

Program: ARCHITECTURAL TECHNICIAN

Semester: THREE

Date: AUGUST, 1988

Author: NORM TRIPLETT

New: X Revision: _____

APPROVED: L. Crozetti 88/09/06
Chairperson Date

CALENDAR DESCRIPTION

ARCHITECTURAL ENGINEERING	ARC 235
Course Name	Course Number

PHILOSOPHY/GOALS:

The general objective of the course is to develop a basic working knowledge of Strength of Materials. This will enable the student to understand and solve basic strength of materials and structural problems at the Technician level.

METHOD OF ASSESSMENT:

The final grade will be based on the average of four term tests, which will carry an equal weight of 25% each.

A+	90 - 100%
A	81 - 89%
B	66 - 80%
C	55 - 65%
R	Repeat
X	A temporary grade, limited to situations with extenuating circumstances, giving a student additional time to complete the requirements of the course.

1. Minimum acceptable grade is 55%.

2. Notice of a term test will be given in class at least one week in advance.

3. Homework problems are assigned during lecture and the solution to selected problems is discussed subsequently. They are not graded.

4. If at the end of the semester your overall average of the combined tests is below 55%, then it will be up to the instructor whether you receive a "R" grade or a rewrite. The criteria employed for arriving at that decision is class attendance, class participation and overall grade.

5. In case a rewrite is granted it will be permitted only once and will be subjected to the following conditions:

   a) It will cover the entire semester's course outline;
   b) The maximum obtainable grade is "C"; and
   c) The student must score a 60% overall average on the rewrite in order to obtain a "C" grade.

PREREQUISITE:

APPLIED MECHANICS (MCH 100)

REFERENCE TEXTS:

Applied Strength of Materials (Jensen/Chenowith)

Mechanics of Materials (Levinson)

Handbook of Steel Construction (C.I.S.C.)

ARCHITECTURAL ENGINEERING

ARC 235

TOPIC NO.	PERIODS	TOPIC DESCRIPTION
1	8	**REVIEW STATICS PRINCIPLES** a) Forces and Vectors b) Moments and Couples c) Equations of Equilibrium
2	20	**FUNDAMENTAL STRESS/STRAIN RELATIONSHIPS** a) Tensile, Compressive, Shear and Bearing Stress b) Ultimate, Allowable Stress, Factor of Safety c) Axial Deformation (Strain) d) Hooke's Law (Modulus of Elasticity) e) Stress/Strain Diagram f) Poisson's Ratio
3	12	**MOMENT OF INERTIA** a) Centroids b) 1st Moment of Area c) 2nd Moment of Area d) Parallel Axis Theorem e) Moment of Inertia f) Radius of Gyration
4	12	**SHEAR & BENDING IN STATICALLY DETERMINATE BEAMS** a) Shear Diagrams b) Bending Moment Diag's. c) Maximum Bending Location d) Max. Deflection - **OPTIONAL**

TOPIC NO.	PERIODS	TOPIC DESCRIPTION
5	8	**RETAINING WALLS** a) Types of Retaining Walls b) Soil Pressure c) Design Considerations

SPECIFIC OBJECTIVES

TOPIC #1:

This review work consists of material covered in Applied Mechanics Text, "Introduction to Mechanics", by Levinson.

The student will be able to:

1. Identify type of force (e.g. push/pull).
2. Calculate vertical and horizontal components if a force acting at an angle to vertical/horizontal reference plane.
3. Draw a force to scale (vector) and identify its magnitude, direction and sense.
4. Add a number of vectors graphically to produce a polygon of forces.
5. Identify the "resultant force" in magnitude and direction.
6. Define the terms, equilibrant and equilibrium.
7. State the 3 equations of equilibrium $\Sigma Fy = 0$ $\Sigma Fx = 0$ $\Sigma Mo = 0$
8. Construct free body diagrams from load carrying member.

TOPIC #2:

The student will be able to:

1. Define stress in qualitative terms.
2. Explain "stress" by using an analogy to pressure.
3. State the formula for uniformly distributed axial stress, using the correct symbols.
4. State the formula for uniformly distributed shear stress, using the correct symbols.
5. State the units of stress, load and area and prove the units of each variable by dimensional analysis.
6. State the formula for bearing stress.

7. Explain the meaning of "double shear" as it applies to the shearing action of a doubly supported pin.

8. Define "factor of safety" in terms of "stress necessary to produce failure" and working stress.

9. Explain the meanings of "working stress", and/or allowable.

10. Complete correctly, the assigned problems involving the concept of stress.

11. Define the terms "strain and deformation" in a qualitative manner.

12. Recall the qualitative meaning of "stress".

13. Given a stress - strain curve for a typical ferrous metal or ferrous allay, identify significant points and features.

14. Distinguish between a true S-S curve and an apparent S-S curve.

15. State Hooke's Law.

16. Define in qualitative terms, Young Modulus, or the modulus of elasticity.

17. From the definition of Young's Modulus and from recalling the definitions of stress and strain, develop the equation for deformation.

18. Manipulate the formula for deformation, solving for any unknown quantity.

19. Explain qualitatively, the behaviour of two materials in series, deforming under axial load.

20. Explain qualitatively, the behaviour of two materials in parallel, deforming under axial load.

21. Define poissons ratio in terms of laterial strain and axial strain.

22. Define the modulus of rigidity in terms of Poisson's ratio and the modulus of elasticity.

TOPIC #3:

The student will be able to:

1. State the formula for the moment of inertia of a rectangular shape about its centroidal X-X and Y-Y axis.

2. State the formula which permits the calculation of the moment of inertia of a rectangular shape about any axis (transfer formula).

3. Locate the correct value for the moment of inertia from structural tables.

4. Explain how the moment of inertia of a composite is found.

5. State the formula relating section modulus, moment of inertia, and the distance from the neutral axis of a beam.

6. Explain the meaning of neutral axis.

7. State the formula relating radius of gyration moment of inertia and area.

8. Correctly complete the assigned problems of Topic #3.

TOPIC #4:

The student will be able to:

1. Illustrate by sketches the difference between point loads uniformly distributed loads, and non-uniformly distributed loads.

2. Explain the method of calculating and checking the reactions for simply supported and cantilever members under the influence of various loadings.

3. Recall the meanings of vertical shear force and bending moment.

4. By the use of free body diagrams of sections of a beam, explain how vertical shear forces and bending moments can be calculated.

5. Draw according to convention, the vertical shear force diagram for a loaded-supported beam.

6. Draw according to convention, the bending moment diagram for a loaded-supported beam.

Correctly complete the assigned problems of Topic #4.

TOPIC #5:

The student will be able to:

1. Identify the base, heel, toe and stem of a retaining wall.
2. Identify active pressure and passive pressure.
3. Identify surcharge loading
4. Identify gravity walls, cantilevered walls and counterfort walls.
5. Calculate the bearing pressure under the retaining wall.
6. Calculate the overturning moment of the retaining wall.
7. Dimension a retaining wall.
8. Calculate the base length.
9. Calculate the design moment for the stem.
10. Calculate the design moment for the heel.
11. Calculate the design moment for the toe.
12. Calculate the safety factors against overturning and sliding.