SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	Strength of Materials
CODE NO.	MCH 212
PROGRAM	Civil Engineering Technology
SEMESTER	III
AUTHOR:	S. Ienco
DATE:	June 1990

NEW: REVISION

APPROVED •jA((Au67 l^tt Vc /Cb

CHAIRPERSON DATE

Strength of Materials MCH 212

COURSE NAME CODE NO.

Total Credit Hours 64

Prerequisite (s) MCH 100

I. **PHILOSOPHY/GOALS**:

Strength of materials builds on the basic knowledge that the student has acquired in his/her introductory statics course.

Consequently, this course will start with a brief review of statics, followed with a basic introduction to strength of materials. The topics covered will include: The free body diagram, framework analysis, stress/strain relationship, Poisson'a ratio, temperature stresses, welded connections, bolted connections, thin-walled pressure vessels, centroid, moment of inertia, radius of gyration, shear force diagrams for beams, bending moment diagrams for beams and flexure formula.

These additional topics form a partial background that prepares the student for the analysis and design of simple structural members.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

1) Investigate and solve problems by sketching the free body diagram and applying the equations of equilibrium,

2) Analyze trusses by graphical method, evaluation of joints and isolation of joints.

3) Apply fundamental principles of stress/strain relationship to analyze and design simple engineering problems.

4) Analyze and design bolted structural joints and welded structural joints.

5) Calculate centroid, moment of inertia and radius of gyration for simple geometric areas and composite areas.

6) Calculate and draw shear force and bending moment diagrams for simple beams.

7) Perform laboratory experiments that will enhance the students basic understanding of stress/strain relationship and load flexure relationships in beams.

Strength of Materials MCH 212

COURSE NAME CODE NO.

III. TOPICS **TO** BE **COVERED:**

1) Brief Statics Review.

2) Truss Analysis.

3) Stress/Strain Relationship.

4) Bolted, Welded Joints and Thin-walled Pressure Vessels.

5) Centroid, Moment of Inertia and Radius of Gyration.

6) Shear and Moment in Beams.

7) Laboratory Experiments.

IV. TOPICS DESCRIPTION

TOPIC NO.	TOPIC DESCRIPTION	REFERENCE
1.	Statics Review - Forces and Units - Force Vectors Manipulation - Free-Body Diagram - Equilibrium Equations - Truss Analysis	Hand-outs & Tutorials
2.	Stress/Strain Relationships - Axial and Shearing Stresses - Units, Ultimate Stress, Allowable Stress, Factors of Safety - Structural Shapes Identification - Analysis and Design Problems - Axial and Shearing Strain - Poisson's Ratio - Elastic Limit, Modulus of Elasticity, Stress-Strain Diagram - Axial Stresses in Members of two Materials - Thermal Stresses	Chapter 1

Strength of Materials MCH 212

COURSE NAME CODE NO.

TOPIC NO.	TOPIC DESCRIPTION	REFERENCE
3.	Bolted, Welded Connections & Thin-walled Pressure Vessels - Types of Bolted Connections - Types of Failures in Bolted Connections - Stresses in Bolted Connections - Analysis and Design of Bolted Connections - Types of Welds - Strength of Welded Connections - Design of Welded Connections - Thin-walled Pressure Vessels	Chapter 3
4.	Centroid and Moment of Inertia - Centre of Gravity of an Area - Centroid of Composite Areas - Moment of Inertia - Transfer Formula - Moment of Inertia of Composite Areas - Radius of Gyration	Chapter 5
5.	Stresses in Simple Beams - Types of Beams and Loadings - End Beam Supports - Shear-Force Diagram - Moment Diagrams - Relationship between Beam Loading Shear Diagram and Moment Diagram - Moving Loads - Flexure Formula	Chapter 6

Strength of Materials MCH 212

COURSE **NAME** CODE NO.

V. REQUIRED STUDENTS RESOURCES (including textbooks and workbooks)

APPLIED STRENGTH OF MATERIALS
Latest Edition
Jensen/Chenoweth
McGraw Hill

VI. METHOD OF EVALUATION

A final grade will be derived from the results of laboratories, quizzes and three tests weighed as follows:

Laboratories, each of equal weight	10%
Quizzes, each of equal weight	15%
Three tests each worth 25%	75%
TOTAL	100%

The grading system used will be as follows:

A+	90% - 100%
A	80% - 89%
B	70% - 79%
C	55% - 69%
R	Repeat

1) Minimum acceptable grade for this course is 55%.

2) The in class quizzes will cover one problem that was dealt with during a lecture or assigned for homework. The quiz problem can be given at any time during class hours without advance notice; and the student is expected to solve the problem under examination conditions.

   The results of these quizzes, in addition to making up part of your overall grade, should be used by the student as a guide to check his/her progress in the course on a regular basis.

3) Homework problems are assigned during lecture, inspected by the instructor during subsequent lecture, followed by a discussion and solution to selected problems.

4 > If at the end of the semester your overall average of the combined laboratories, quizzes and three tests is below 55%, then it will be up to the instructor whether you receive an R repeat or a rewrite. The criteria employed for arriving at that decision is class attendance, class participation and overall grade, which should be a least 45V*.

5) In case a rewrite is granted, it will be permitted only once, it will cover the entire course outline, and it will limit the maximum obtainable grade for the course to 60%.

VII. LEARNING ACTIVITIES

l.Q STATICS REVIEW

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

1.1 Draw free body diagrams to investigate and solve problems.

1.2 Solve problems using the three basic equations of equilibrium.

2.0 TRUSS ANALYSIS

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

2.1 Solve for end reactions in frameworks with symmetrical and unsymmetrical loads.

2.2 Analyze frameworks by method of joints.

2.3 Analyze frameworks by method of sections.

2.4 Analyze frameworks by graphical method.

3.0 STRESS/STRAIN RELATIONSHIP

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

3.1 State, define and illustrate by example the basic equations of axial and shear stresses.

3.2 Apply the basic stress equations to solve common engineering problems.

3.3 State and define the meaning of design and analysis.

3.4 Identify simple structural members.

3.5 State, define and illustrate by example the basic equations for normal strain.

3.6 State, define and illustrate by example elasticity, elastic limit and modulus of elasticity.

3.7 Solve problem involving strain and modulus of elasticity.

3.8 State, illustrate and define by example shearing strain and Poisson's ratio.

3.9 Solve problems involving shearing strain and Poisson's ratio.

3.10 State, define and illustrate by example the relationship between stress, strain and modulus of elasticity.

3.11 State, define and illustrate by example the concept of yield stress, permanent set, percent elongation, ultimate stress, allowable stress and factor of safety.

3.12 Reinforce his/her basic knowledge of the stress/strain relationship, by performing tensile laboratory experiments on various steel samples,

3.13 Solve problems in deformation for two materials in series under axial load or two sizes of the same material in series under axial load.

3.14 Solve problems in deformation for two materials in parallel, deflecting equally under axial load.

3.15 State, define and illustrate by example the equations for thermal expansion or contraction and thermal stresses.

3.16 Solve problems involving thermal expansion or contraction and thermal stresses.

Strength of Materials MCH 212

COURSE NAME CODE NO.

4-0 BOLTED WELDED JOINTS AND THIN-WALLED PRESSURE VESSELS

Upon successful completion of this unit, the student will be able

4.1 State, define and illustrate by example types of structural bolted connections, bearing stresses, shearing stresses and typical failure modes.

4.2 State, define and illustrate by example allowable stresses, bearing-type connections and friction-type connections.

4.3 Analyze structural bolted connections using the working strength method.

4.4 Design structural bolted connections using the working strength method.

4.5 State, define and illustrate by example types of welds (fillet, butt, plug, slot, spot).

4.6 Solve problems involving welded connections that support direct loads.

4.7 Solve problems involving welded connections that support eccentric loads.

4.8 Design welded connections using the working strength design.

4.9 State, define and illustrate by example thin-walled pressure vessels, longitudinal stresses and circumferential stresses.

4.10 Develop the stress equations for thin-walled pressure vessels.

4.11 Solve problems involving thin-walled pressure vessels.

5.0 CENTROID, MOMENT OF INERTIA & RADIUS OF GYRATION

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

5.1 State, define and illustrate by example the concepts of centre of gravity and centroid of an area.

5.2 Solve problems involving centroid of composite areas.

5.3 State, define and illustrate by example the concepts of moment of inertia of simple areas, moment of inertia of composite areas and radius of gyration.

5.4 Calculate the moment of inertia for built-up structural shapes, using structural tables.

5.5 Calculate the radius of gyration of built-up structural shapes.

6.0 SHEAR AND MOMENT IN BEAMS

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

6.1 State, define and illustrate by example types of beams, supports and loading (point, uniformly distributed and triangular).

6.2 State, define and illustrate by example the concept of shear and bending moment in simple beams.

6.3 Calculate end reactions, shear and moment in beams.

6.4 Determine critical sections of maximum shear and maximum moment in beams.

6.5 Draw shear and bending moment diagrams for beams loaded with point loads and geometric loads.

6.6 State, define and illustrate by example the concept of shear force and bending moment for simple beams with moving loads.

6.7 Solve problems involving beams with moving loads.

6.8 State, define and illustrate by example the concept of internal stresses in a beam

6.8 Solve beam problems involving the flexure formula.

6.9 Perform a laboratory experiment to observe the load deflection relationship for a simple beam loaded with a point load.