SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: STRENGTH OF MATERIALS

Code No.: ARC 200

Program: ARCHITECTURAL TECHNICIAN (DRAFTING)

Semester: III

Date: JUNE, 1983

Author: G. FRECH

New: _____ Revision: X

APPROVED: _____ Chairperson _____ Date

CALENDAR DESCRIPTION

ARCHITECTURAL ENGINEERING II	ARC 200
Course Name	Course Number

PHILOSOPHY/GOALS:

The student will have a basic knowledge into material behaviour under loads. This will assist the student in design of members for architectural design when applied to the structural design course.

METHOD OF ASSESSMENT (GRADING METHOD):

A - 86 - 100%
B - 70 - 85%
C - 55 - 79%
R - Repeat
X - Work to be made up or upgraded under special circumstances

Marks will be accumulated and averaged using tests and assignments. Final testing will be given to students not achieving 75% average with no failures or 80% average with one test between 50-54%. Attendance, lateness and attitude will be considered in assessments.

TEXTBOOK(S):

Applied Strength of Materials
Jensen and Chenoweth

TOPIC NO.	TOPIC INFORMATION
1	REVIEW STATICS Forces Units Moments Vectors
2	DIRECT STRESS Axial Stress Bonding Stress Tension Compression Shear
3	THIN WALLED CYLINDERS Longitudial stress Circumferencial Stress
4	STRESS - STRAIN Hookes Law Strain Deformation Single Materials Two Materials
5	THERMAL STRESS Co-efficient of expansion Deformation
6	CONNECTIONS Bolted Riveted Shear
7	CENTROIDS AND MOMENT INERTIA 1st Momentum of areas 2nd Momentum of areas
8	SHEAR AND BENDING DIAGRAMS Point loads Uniform loads Simple beams Cantilever Overhanging

PERFORMANCE OBJECTIVES FOR STRENGTH OF MATERIALS

ARC 200

DIRECT STRESS

1. Identify the main units in engineering measurement.
2. Identify the three laws of equilibrium.
3. Identify the three kinds of stress, tension, compression and shear.
4. Identify simple direct axial stress and be able to solve for any one unknown to the direct stress formula unit stress - load/cross section area.
5. Identify ultimate stress.
6. Identify and solve factor of safety.
7. Identify working stress, being able to calculate if from factor of safety and being able to apply this relationship in design and strength of materials.

THIN WALLED CYLINDERS

1. Identify thin walled pressure vessels.
2. Identify stress in a longitudinal direction of the cylinder shell.
3. Be able to develop the formula for stress in the longitudinal direction of a thin walled cylinder and be able to solve for any one unknown.
4. Identify stress in a circumferential direction of the cylinder shell.
5. Be able to develop the formula for stress in the circumferential direction of a thin walled cylinder and be able to solve for any one unknown.
6. Identify the stress in the wall of a thin cylinder if the cylinder is a sphere.
7. Solve simple problems for stresses in either direction of circumferential or longitudinal or for any one unknown in the formulae for either case.

STRESS STRAIN

1. Identify strain and total deformation.
2. Distinguish between strain and stress.
3. Interpret the stress strain curve, being able to name all the parts of the curve; the relationship of elastic range, ultimate strength, permanent set.
4. Identify Hooke's Law.
5. Identify and calculate Young's Modulus (Modulus of Elasticity) the relationship of stress and strain.

6. Develop the total deformation formula from the direct stress formula and Modulus of Elasticity formula.
7. Manipulate the formula for deformation, solving for any one unknown quantity.
8. Solve the deformation formula should there be unknowns in either the direct stress formula, he Modulus of Elasticity formula, or in both.
9. Solve problems in deformation for one material under axial load.
10. Solve problems in deformation for two materials in series under axial load or two sizes of the same material in series under axial load.
11. Solve problems in deformation for two materials in parallel, deflecting equally under axial load.
12. Identify Poisson's Ratio; the relationship between axial deformation to lateral deformation.
13. Solve problems in deformation which include Poisson' Ratio.

THERMAL STRESS

1. Understand what thermal expansion or contractionis and be able to solve simple problems using standard linear coefficients of thermal expansion.

2. Identify thermal stress with direct stress being able to compare and relate the thermal formula to that of the direct stress formula.
3. Solve basic problems in temperature stress using the formula with only one unknown quantity.

SHAPES AND CONNECTIONS - BOLTED, RIVETED

1. Identify structural shapes.
2. Use tables of structural shapes, being able to distinguish parts, dimensions and the design tables from detail tables.
3. Write and sketch structural shapes; the standard method of calling for; know their parts and the difference between the strong and weak axes.
4. Identify the allowable stresses for structural grades of steel and timber.
5. Identify and compare structural connectors; rivets and bolts.
6. Identify single shear and double shear in connectors.
7. Identify bearing in riveted or bolted connections.
8. Calculate shear values for different sizes of connectors.
9. Calculate bearing values for different thickness of plate on different sizes of connectors.
10. Identify the design value to use between shear and bearing and understand these two checks made in connections.
11. Calculate the number of connectors required where the axial load is known and sizes of material being connected.
12. Calculate the capacity of a connection when working stresses and materi sizes are known.
13. Identify tension members and be able to know and calculate gross area and net area.
14. Do the calculation for tension member design.

WELDED CONNECTIONS

1. Identify types of electric arc welds; square butt, prepared butt, fillet, plug and slat.
2. Calculate capacity of butt welds.
3. Identify fillet welds.
4. Sketch a fillet weld showing its parts.
5. Identify the rules for sizes of fillet welds.
6. Calculate the value of fillet welds, knowing the size and being able to use the throat area.
7. Calculate lengths of fillet welds to carry direct loads, knowing materials size and working stresses.
8. Calculate lengths of fillet weld at the toe and heel of an angle welded to place when the load to be carried is known.
9. Calculate the amount of fillet weld to develop the full strength of a structural shape or plate.

CENTROIDS

1. Identify the first moment of areas (centroids)
2. Calculate centroids of simple rectangular shapes and/or irregular rectangular shapes. This will include triangle and/or circles along with the rectangle.
3. Calculate centroids of built up standard structural shapes or structural shapes and plate making use of structural tables for areas and centers of gravity of the shapes.

MOMENT OF INERTIA, SECTION MODULUS

1. Identify the moment of inertia formula for rectangular shapes, recognizing how to use the formula about either the x-x or y-y axis or both.
2. Identify the second moment of areas (Moment of Inertia) and be able to calculate moment of inertia using the transfer formula for rectangular shapes.
3. Calculate moment of inertia for built up structural shapes, using structural tables for information required in the transfer formula.
4. Identify section Modulus and be able to calculate S from moment of Inertia knowing the meaning of distance form neutral axis to extreme fibers.
5. Identify radius of gyration being able to calculate it knowing moment of Inertia.
6. Identify the flexure formula and be able to manipulate it in its different forms.

SHEAR AND BENDING DIAGRAMS

1. Identify paint (concentrated) and uniformly distributed (U.D.L.) loads.
2. Calculate reactions for simple beams under point U.D.L. or combinations of both, by use of moments.
3. Identify simple, overhanging and cantilever beams.
4. Identify the rule for shear at any point in a beam.
5. Identify the rule for moments at any point in a beam.
6. Calculate shear at any point in simple beams.
7. Calculate bending moment at any point in simple beams.
8. Draw bending moment diagrams to scale for simple beams.
9. Draw bending moment diagrams to scale for simple beams.
10. Calculate maximum bending moment in a simply supported beam under simple or combination loading.
11. Calculate Section Modules by use of the flexure formula.
12. Use the structural tables to choose the most economical beam.
13. Calculate shear and bending maximums due to moving loads.