

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**

**SAULT STE. MARIE, ONTARIO**



Sault College

**COURSE OUTLINE**

**COURSE TITLE:** MECHANICS OF MATERIALS  
**CODE NO. :** MCH212 **SEMESTER:** 3  
**PROGRAM:** ARCHITECTURAL/CIVIL/CONSTRUCTION  
**AUTHOR:** SAL IENCO  
**DATE:** AUG 06 **PREVIOUS OUTLINE DATED:** AUG 05  
**APPROVED:**  

	_____	_____
	<b>DEAN</b>	<b>DATE</b>

  
**TOTAL CREDITS:** 4  
**PREREQUISITE(S):** MCH 100  
**HOURS/WEEK:** 4

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## **I. COURSE DESCRIPTION:**

The topics covered in this course include: The free body diagram, stress/strain relationship, Poisson's ratio, temperature stresses, welded connections, bolted connections, centroid, moment of inertia, shear force diagrams for beams, bending moment diagrams for beams and flexure formula.

## **II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:**

Upon successful completion of this course, the student will demonstrate the ability to:

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

### Potential Elements of the Performance:

- State, define and illustrate by example the basic equations of axial and shear stresses.
- Apply the basic stress equations to solve common engineering problems.
- State and define the meaning of design and analysis.
- Identify simple structural members.
- State, define and illustrate by example the basic equations for normal strain.
- State, define and illustrate by example elasticity, elastic limit and modulus of elasticity.
- Solve problem involving strain and modulus of elasticity.
- State, illustrate and define by example shearing strain and Poisson's ratio.
- Solve problems involving shearing strain and Poisson's ratio.
- State, define and illustrate by example the relationship between stress, strain and modulus of elasticity.
- State, define and illustrate by example the concept of yield stress, permanent set, percent elongation, ultimate stress, allowable stress and factor of safety.
- Solve problems in deformation for two materials in series under axial load or two sizes of the same material in series under axial load.
- Solve problems in deformation for two materials in parallel, deflecting equally under axial load.
- State, define and illustrate by example the equations for thermal expansion or contraction and thermal stresses.

Potential Elements of the Performance Continued:

- Solve problems involving thermal expansion or contraction and thermal stresses
  - Perform a tensile laboratory experiments on various steel samples
2. Analyze and design bolted structural joints and welded structural joints.

Potential Elements of the Performance:

- State, define and illustrate by example types of structural bolted connections, bearing stresses, shearing stresses and typical failure modes.
  - State, define and illustrate by example allowable stresses, bearing-type connections and friction-type connections.
  - Analyze structural bolted connections using the working strength method.
  - Design structural bolted connections using the working strength method.
  - State, define and illustrate by example types of welds (fillet, butt, plug, slot, spot).
  - Solve problems involving welded connections that support direct loads.
  - Design welded connections using the working strength design.
  - State, define and illustrate by example thin-walled pressure vessels, longitudinal stresses and circumferential stresses.
  - Develop the stress equations for thin-walled pressure vessels.
  - Solve problems involving thin-walled pressure vessels.
3. Calculate centroid, moment of inertia and radius of gyration for simple geometric areas and composite areas.

Potential Elements of the Performance:

- State, define and illustrate by example the concepts of center of gravity and centroid of an area.
- Solve problems involving centroid of composite areas.
- 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.
- Calculate the moment of inertia for built-up structural shapes, using structural tables.
- Calculate the radius of gyration of built-up structural shapes.

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

Potential Elements of the Performance:

- State, define and illustrate by example types of beams, supports and loading (point, uniformly distributed and triangular).
- State, define and illustrate by example the concept of shear and bending moment in simple beams.
- Calculate end reactions, shear and moment in beams.
- Determine critical sections of maximum shear and maximum moment in beams.
- Draw shear and bending moment diagrams for beams loaded with point loads and geometric loads.
- State, define and illustrate by example the concept of shear force and bending moment for simple beams with moving loads.
- Solve problems involving beams with moving loads.
- State, define and illustrate by example the concept of internal stresses in a beam
- Solve beam problems involving the flexure formula.
- Perform a laboratory experiment to observe the load deflection relationship for a simple beam loaded with a point load.

**III. TOPICS:**

1. Stress/Strain Relationships
2. Bolted and Welded Joints
3. Center of Gravity, Centroids and Moment of Inertia
4. Shear Force and Bending Moments in Beams

**IV. REQUIRED RESOURCES/TEXTS/MATERIALS:**

Applied Statics and Strength of Materials

Thomas Burns

**V. EVALUATION PROCESS/GRADING SYSTEM:**

You will be assigned a final grade based on successful completion of laboratories, assignments and tests, weighted as follows:

Laboratories/Assignments/Quizzes	30%
Two term tests of equal weight	40%
Final Test	<u>30%</u>

**TOTAL 100%**

Each laboratory/assignment/quiz carries equal weight. Late submittals receive only a maximum grade of 50%. However, laboratories or assignments handed in later than one week will receive a grade of 0%.

An average of 50% on laboratories/assignments and 50% on tests is required for successful completion of this course.

The following semester grades will be assigned::

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 - 100%	4.00
A	80 - 89%	4.00
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 - 59%	1.00
F (Fail)	49% and below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

**VI. SPECIAL NOTES:**

Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Special Needs office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

**VII. ACADEMIC / CLASSROOM CONDUCT**

Introduction: Sault College students, faculty members, employees and Ray Lawson Hall Residents constitute an academic community committed to training and education that will enhance effectiveness in the workplace and quality of life. The College community expects all members to discipline themselves, individually and collectively, and it requires adherence to the standards of conduct appropriate for an academic community.

Sault College considers its students adults and as such obligated to make responsible decisions. The Student Code of Conduct exists to assist in the effort of providing the best possible learning and living environment for all students. It is the obligation of students to treat all other members of the academic community with dignity and respect – including other students, faculty members, employees, visitors and neighbors of the College. The enforcement of the Student Code of Conduct is critical to the existence of such an environment for all members of the academic community. Ignorance of the rules or of the law is not a defense against disciplinary action. The College reserves all rights to criminal action where it deems necessary. Lack of intention to violate College policy will not generally excuse an infraction.

Academic Dishonesty:

Students shall submit written or other work in a course that shall be the product of their own efforts. "Academic Dishonesty" includes, but is not limited to, the following:

- a. Copying from another student's paper.
- b. Using material not authorized by the person administering the test or assignment.
- c. Collaborating with another student during a test without permission.
- d. Plagiarism (i.e. representing the work of another, as one's own, inclusive of purchases of a commercial nature).
- e. Collusion (i.e. obtaining from or giving to another student unauthorized assistance in course work).
- f. Falsification (i.e. modification, without authorization, of any examination paper, record, assignment, or report).
- g. Knowingly using, buying, selling, stealing, or soliciting contents of a test, examination paper, record, assignment, or report.
- h. Representing oneself as another student for the purpose of taking a test or examination or allowing oneself to be represented by another for the same
- i. Attempting to bribe or otherwise coerse a professor/instructor to obtain favours.
- j. Cheating (i.e. any misrepresentation by a student of their performance in a College subject for the purpose of obtaining credit to which they are not entitled).
- k. Any act designated by the President or his/her designate.

(Student Code of Conduct – Article 2, Section 2)

Attendance:

Students are expected to attend 100% of their classes. Attendance will be recorded within the first 15 minutes of each class.

Leaving or Entering During Class:

Students should exercise respect for faculty and students when leaving or entering a class that is already in session. Leaving or entering should be done with a minimal amount of interruption.

Disruption:

Students shall not obstruct or disrupt, or attempt to obstruct or disrupt, teaching, administration, disciplinary procedures, or other College activities.

(Student Code of Conduct – Article 2, Section 9)

Use of Electronic Devices:

*General:* Taking photos or making audio/video recordings on Sault College property without permission in ANY context in which the person being photographed or recorded has a reasonable expectation of privacy is prohibited. Examples include but are not limited to:

*Classrooms:* The use of cell phones, photographically capable cell phones, pagers and other communication/electronic devices during classes, clinical or field placement is prohibited unless authorized by faculty.

*Examinations:* The use of cell phones, photographically capable cell phones, pagers and other communication/electronic devices during exams and midterms is prohibited unless authorized by faculty in charge.

(Student Code of Conduct – Article 2, Section 31)

**SANCTIONS**

College staff may impose sanctions in accordance with their responsibilities. Sanctions, which are imposed, may become part of the student's official record and are removed one year and one term after the student's last academic activity at Sault College.

The College shall make sanctions concerning students' actions and offences occurring within or affecting people on Sault College owned or controlled property, including but not limited to Ray Lawson Hall Residence, Sault College Aviation Hangar, off-campus at a College-sponsored event, or when such actions or offences at a non-College event off-campus have a direct impact on students' on-campus. The College reserves the right to assess any sanction it may deem appropriate. A serious breach or continuation or a repetition of behavior in violation of the Student Code of Conduct will be cause for further sanctions up to and including expulsion.



**Sanctions for Academic Dishonesty may include the following:**

1. A professor/instructor may assign a sanction as defined below, or make recommendations to the Dean for disposition of the matter. The professor/instructor may:
  - issue a verbal reprimand
  - make an assignment of a lower grade with explanation
  - require additional Academic assignments and issue a lower grade upon completion, to the maximum grade "C"
  - make an automatic assignment of a failing grade
  - recommend to the Dean, dismissal from the course with the assignment of a failing grade recommend to the Dean, dismissal from the College for a definite or indefinite period of time with a failing grade.
2. If the student denies the allegation of academic dishonesty the student should discuss the matter with the Director of Student Services immediately. If the matter cannot be resolved the student should file an Academic Appeal within three (3) working days. The appeal would automatically move to Step Two – Academic Appeal.

(Student Code of Conduct – Article 4)

**Testing Absence**

If a student is unable to write a test for medical reasons on the date assigned, the following procedure is required:

- In the event of an emergency on the day of a test, the student must telephone the College to identify the absence. The college has a 24-hour electronic voice mail system (759-2554) Ext. 2600. Documentation may be required to support the absence.
- The student shall provide the Professor with advance notice preferably in writing or e-mail of his/her need to miss the test.
- The student may be required to document the absence at the discretion of the Professor.
- All decisions regarding whether tests shall be re-scheduled will be at the discretion of the Professor.
- The student is responsible to make arrangements, immediately upon their return to the College with their course Professor in order to make-up the missed test prior to the next scheduled class for the course in question.

**VIII. PRIOR LEARNING ASSESSMENT:**

Students who wish to apply for advanced credit in the course should consult with the professor and the college's academic counsellors. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

**IX. DIRECT CREDIT TRANSFERS:**

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.