SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: CONSTRUCTION MATERIALS

CODE NO.: ARC 133 **SEMESTER:** 1995W

PROGRAM: ARCHITECTURAL/CIVIL ENGINEERING

AUTHOR: S. IENCO

DATE: AUGUST 1994 **PREVIOUS OUTLINE DATED:** JANUARY 1991

APPROVED: L S Chaput 94-08-31
DEAN DATE

M. Ienco Aug 31/94

CONSTRUCTION MATERIALS — COURSE NAME

ARC 133 — CODE NO.

TOTAL CREDIT HOURS: 64

PREREQUISITE(S): NONE

I. PHILOSOPHY/GOALS:

The student will be introduced to various construction materials such as aggregates , concrete, asphalt and wood. Understanding of the physical and engineering properties of these materials will be accomplished by way of lectures, laboratory testing and class presentations.

II. STUDENT PERFORMANCE OBJECTIVES (OUTCOMES):

(References: CSAC PROJECT Draft No. 3B - June 2, 1993 and NATIONAL STANDARDS CIVIL TECHNOLOGIES -January 1994)

Upon successful completion of this course the student will:

1) **List the types of soil and rock deposits used for aggregates in Ontario and in local areas, and estimate types and potential quantities of material contained in a deposit.**

2) **Perform standard aggregate tests such as mechanical sieve analysis, wash test, relative density, bulk density, saturated surface dry and apparent density tests, and absorption, soundness tests and abrasion following prescribed CSA (Canadian Standard Association) or ASTM (American Society for Testing and Materials) standards.**

3) **Design and test Portland cement concrete mixes to satisfy design criteria such as Water/cement ratio, aggregate blending, admixture selection and trial batch procedures.**

4) **Design and calculate asphaltic concrete mixes using Marshall method and industrial standard specifications.**

5) **Research, design, construct and test to ultimate failure a wooden truss.**

III. TOPICS TO BE COVERED:

1) **Aggregate Sources.**

2) **Aggregate Sampling and Testing.**

3) **Portland Cement Concrete.**

4) **Asphalt Concrete.**

5) **Wood.**

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IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

(References: CSAC PROJECT Draft No. 3B - June 2, 1993 and NATIONAL STANDARDS CIVIL TECHNOLOGIES -January 1994 and NATIONAL REFERENCE STANDARDS NRS K202/87)

1. Aggregate Sources

Learning Activities:

- State, define and describe the origin, formation, sources and properties of aggregates including: shape, size, texture , density, absorption, strength, toughness and soundness.
- Describe typical aggregate bearing landforms.
- Identify current applicable standards pertaining to aggregate properties for various construction uses.

Resources:

Chapter 4 and parts of chapter 2 - text, Engineering Geology Terrain Maps and handouts.

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2. Aggregate Sampling and Testing

Learning Activities:

- Describe the procedure for extracting representative samples of aggregates from conveyors, stockpiles, trucks, barges, bins and pit faces in accordance to recommended practices and using common sampling techniques.
- Determine the size of sample required for any test to be performed on the aggregate.
- Identify the source of sample by using correct labelling procedures.
- Identify the proper tests required to determine a specific property of coarse and fine aggregate.
- Perform the standard tests and calculate or assess the results, including: Sieve analysis, washed sieve analysis, relative density and absorption (coarse Aggregate), relative density and absorption (fine aggregate), Soundness test and abrasion test.
- Solve problems assigned from chapter 4 and handouts.

Resources:

- Chapter 4 - text and MTO standards.

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IV. LEARNING ACTIVITIES/REQUIRED RESOURCES (Continued)

3. Portland Cement Concrete

Learning Activities:

- Describe the manufacture of Portland cements, the types produced and their uses in construction.
- Describe Portland cement concrete including materials used, the hydration process, water/cement ratio, curing requirements, workability, air content, admixtures and criteria used to measure properties.
- Recognize methods used to improve durability of Portland cement concrete when exposed to freeze/thaw cycles, road deicing chemicals and other destructive environments.
- Prepare a Portland cement concrete mix, sample and test for slump, air content, density.
- Cast fresh concrete cylinders.
- Complete compression testing of standard cured concrete including: capping, breaking, recording, plotting and evaluating results.
- Describe practices used in the mixing, transportation, placing and finishing Portland cement concrete on construction projects.
- Solve problems assigned from chapter 7 and handouts.

Resources:

- Chapter 7 - text, films, slides and handouts.

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4. Asphalt Concrete

Learning Activities:

- Identify the types and uses of asphaltic cements.
- Identify tests used to design asphaltic concrete paving mixtures, sample asphalt mixes and conduct tests for air content, density and stability.
- Design and calculate asphaltic concrete mixes using the Marshall method.
- Illustrate and explain the various asphalt plants including: component functions, performances, and quality control requirements.
- Describe procedures involved in recycling and placing of asphaltic concrete.
- Solve problems assigned from chapter 6 - text and handouts.

Resources:

Chapter 6 - text, movies, slides and handouts.

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IV. LEARNING ACTIVITIES/REQUIRED RESOURCES (Continued)

5. Wood

Learning Activities

- Research in the library and with industry and report on grades and engineering properties of wood.
- Research, design, draft, construct and test to ultimate failure a scaled down version of one of the following trusses: Bowstring, Warren, Pratt, Fink, Howe, Scissor or a combination truss.
- Produce a formal type written report on all phases of the truss project.

Resources

- Library and industry resources.

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V. EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.)

A final grade will be derived as follows:

Laboratory work	25%
Truss project	15%
Three Term Tests of equal weight	60%
	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. Each laboratory will carry equal weight. Late submisions will be penalized with a loss of 20% for the first day late and an additional 10% for each subsequent late day.

3. If at the end of the semester the overall mark of the combined laboratory work, project and tests is below 55%, then it will be up to the instructor whether or not a rewrite test will be granted. The criteria employed for arriving at that decision is class attendance, class participation and overall grade, which should be at least 45%.

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V. EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.) Continued.

4. In the 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%.

5. Testing Absence:

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

a. The student shall provide the Professor with advance notice preferably in writing of his/her need to miss a test.

b. The student may be required to document the absence at the discretion of the professor.

c. All decisions regarding whether tests shall be re-scheduled will be at the discretion of the Professor.

d. The student is responsible to make arrangements, immediately upon return to the College with his/her course Professor related to make-up of the missed test prior to the next scheduled class for the course in question.

e. In the event of an emergency on the day of the test, the student may require documentation to support the absence and must telephone the College to identify the absence. The college has a 24 hour electronic voice mail system (759-2554).

Failure to comply with these guidelines may result in a zero grade being recorded for the missed test.

VI. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

- **Portfolio component**
- **Laboratories and project**
- **Challenge examination**

VII. REQUIRED STUDENT RESOURCES

Highway Materials, Soils and Concretes
Latest Edition
Harold N. Atkins

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VIII. SPECIAL NOTES

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.

IX. COURSE ANALYSIS SHEET (see instructor)

COURSE ANALYSIS FORM

Course Title and No. ARC133

Learning Outcomes	Broad Areas of Content	Indicator of Importance (if applicable)	Indicators of Success
1. List the types of soil and rock deposits used for aggregates in Ontario and in local areas, and estimate types and potential quantities of material contained in a deposit.	- Identify sources of aggregates - Describe method of extraction and processing - Outline properties and uses of aggregates		- Successful completion of challenge examination and/or portfolio.
2. Perform standard aggregate tests such as mechanical sieve analysis, wash test, relative density, bulk density, saturated surface dry and apparent density tests, and absorption, soundness tests and abrasion following prescribed CSA (Canadian Standard Association) or ASTM (American Society for Testing and Materials).	- Perform aggregate test in accordance to industry standards.		- Successful completion of challenge examination and/or portfolio and/or laboratory testing.
3. Design and test Portland cement concrete mixes to satisfy design criteria such as Water/cement ratio, aggregate blending, admixture selection and trial batch procedures.	- Design concrete mixes - Mix, form and cure concrete cylinders - Test fresh and hardened concrete		- Successful completion of challenge examination and/or portfolio and/or laboratory testing.
4. Design and calculate asphaltic concrete mixes using Marshall method and industrial standard specifications.	- Design asphalt concrete mixes - Perform asphalt concrete tests		- Successful completion of challenge examination and/or portfolio and/or laboratory testing.
5. Research, design, construct and test to ultimate failure a wooden truss.	- Research - Construct - Test and report		- Documentation of an acceptable experimental project from start to end.

Assessment Process

- Register at the PLA office
- Pay $55.00 at the registrar's office
- Retain receipt
- Schedule laboratory testing
- Prepare portfolio
- Prepare and write challenge examination
- Evaluation

Assessment Tools

- Challenge examination
- Laboratory equipment

Supports

- Highway Materials, Soils, and Concretes - Harold N. Atkins
- ASTM laboratory testing procedures
- Orientation to laboratory facility by technologist or professor.

Requirements for Successful Completion of Course

- Minimum of 60% on each of the Challenge examination, laboratory testing and portfolio component.

A challenge process for this course can be made available to learners within a reasonable period of time following a learner's request.
Signatures:

_____ _____

Professor Program Coordinator or Dean

_____ _____

Date