SAULT COLLEGE
of Applied Arts and Technology
Sault Ste. Marie

COURSE OUTLINE

FOREST UTILIZATION

FOR 210-3

revised March, 1979 by B. Price

Topic Number	Periods	Topic Description	Reference
1		Origin & Classification of Ontario Soils An elementary study of soil formation, soil water, soil structure and soil classification of Canada as it applies to Ontario. A) Soil Origin 1. The earth as a planet. a) the interior b) continents and ocean basins c) the four spheres - lithosphere - hydrosphere - atmosphere - biosphere d) conflicts between internal & external processes - internal processes - external processes - interaction 2. Rocks & Geologic Cycles a) the importance of rock b) the water cycle c) the three classes of rocks - igneous - metamorphic - sedimentary d) the rock cycle e) Geologic time 3. Weathering a) chemical decay b) mechanical breakup 4. Mass-wasting 5. Streams - transport of sediment 6. Ancient environments a) environment today b) environments in the past - Ordovician Sea - Paleozoic North America - Cretaceous North America 7. Natural Vegetation a) establishment of vegetation on land - seedless plants - seed searers b) Gymnosperms c) Angiosperms d) Natural vegetation regions of Ontario	

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8. Climate
   a) significance
   b) temperature
      - growing season
      - growing degree-days
   c) precipitation
   d) Koppen Classification
   e) Soil Climates of Canada
      - temperature classes
      - moisture sub-classes.

9. Glaciers & Glacial Action in Ontario
   a) landforms shaped by glacial ice
   b) landforms shaped by waves
   c) landforms shaped by wind
   d) Fluvio-glacial deposits
   e) Lacustrine and Marine Deposits
   f) Recession of the glacier in Ontario

B) Soil Formation, Structure and Water

1. Soil Formation
   a) soil definitions
      - geological and engineering
      - biological
   b) pedology
      - concept of the pedon
   c) identification of soil profiles and horisons
      - soil description
      - organic layers
      - mineral horizons
   d) Stages
   e) Additions
   f) Removals
   g) Transformations
   h) translocations

2. Soil Structure
   a) definition
   b) units of soil structure
   c) types of soil structure
   d) importance of structure in subsoils

3. Soil Water
   a) How soils hold moisture
   b) Soil moisture tension
   c) sub-divisions of soil water
   d) Forms of soil water
   e) Percent water calculations
   f) Measuring soil water
   g) Relation between percent water and soil moisture tension.
   h) water movement in soils
      - capillary
      - permeable

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i) Plant use of soil water
j) Factors affecting the available water-holding capacity of soils.
k) Aeration pore space in soils
l) absorption of plant nutrients
m) fertilizers and water

C) Soil Classification

1. Interpretive Classification
- soil capability classification

2. Taxonomic Classification
a) the soil profile
b) soil horizon symbols

3. System of soil classification for Canada
a) divisions and categories
b) description of soils and mapping units in Ontario
- Luvisolic soils
- Podzolic soils
- Brunisolic soils
- Regosolic soils
- Gleysolic soils
- Organic soils

c) Identification of soil orders and great groups
d) The location in Ontario of the dominant soil great groups.

II Soil Mechanics

A study of site investigative methods useful in understanding soil properties and road pavement construction and performance. Laboratory testing of soil materials is carried out to qualify the subgrade soil and to determine soil pavement material quality, optimize its use and assess work performed when laying the pavement material.

A) Sieve Analysis
1. Standard method of test for sieve or sereen analysis of fine and coarse aggregates ASTM C 136-67
2. Pre-test
3. Laboratory test and analysis of soil sample

B) Compaction
1. Method of test for moisture-density relations of soils using 10 lb. rammer and 18 in. drop.
2. Pre-test

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3. Laboratory test and analysis on soil sample to determine Proctor value and optimum moisture content.

C) Density of Soil in Place

1. Standard method of test for density of soil in place by either:
   a) the sand-cone method ASTM D 1556-64
   or b) the rubber balloon method ASTM D 2167-66
2. Pre-test
3. Laboratory test and analysis of a road pavement.

D) Liquid Limit

1. Standard method of test for liquid limit of soils ASTM D 423-66
2. Pre-test
3. Laboratory test and analysis of soil sample to determine its liquid limit.

E) Plastic Limit and Plasticity Index

1. Standard method of test for plastic limit and Plasticity Index of soils.
2. Pre-test
3. Laboratory test and analysis of soil sample to determine Atterberg Limits

F) Structural Strength of Soils

1. Field Shear test
2. California Bearing Ratio

III Forest Roads

Forest roads, forest road planning, all-weather road location and construction is studied. A problem in planning, locating and mapping a minimum of seven miles of Class I all-weather roads is solved. Intensive use is made of aerial photographs to plan, locate, map and interpret the terrain.

A) Forest Roads

1. Structural parts of a road
2. Standard classification for forest roads
   a) ALSAT-L system
3. Drainage and frost action
4. Dirt and gravel roads
5. gravel types
6. improved surfaces

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7. Optimum road quality

B) Forest Road Planning

1. The process of air photo interpretation
2. Identification of the land form.
3. Classification of the terrain factors.
4. Identification of the soil texture
5. Soil Moisture Regime
6. Control points

C) All-weather Road Location

1. Features:
   a) principles
   b) key points
2. Organization of field party
3. Office and field procedures
   a) office
   b) reconnaissance survey
   c) route survey
   d) bridge site survey
4. Drainage
   a) low cuts
   b) ditching
   c) culvert size
   d) bridge size
5. Simple curves for Forest Roads
   a) degree of curve required
   b) tangent offset method

IV A Problem in Road Locating, Mapping & Data Collecting for a Class I Road over a minimum distance of seven miles

a) Layout on aerial photos
b) Mapping road location and detail
c) Data
   - tangents
   - terrain

V Field problem in route layout and design

A) Traversing, chaining, levelling and mapping field work.

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B) Curve staking in the field

C) Plotting Field Surveys

1. Traverse
2. Profile
3. Map
4. Curve

D) Determination of bridge end area opening.

E) Setting grade Lines

VI. Quantity Estimation

A) Determination of cut and fill material quantities where the route is:

1. relatively flat
2. requires extensive cutting and filling to meet grade location.

VII Road Construction

A) Preliminary construction features

1. Clearing
2. Close cutting
3. Grubbing

B) Drainage

1. Surface
2. Sub-surface

C) Earthworks

1. General
2. cuts
3. Fill
4. Grading

D) Swamp Treatment

1. low cut
2. drainage

E) Rockwork

F) Gravelling

G) Good construction practices

H) Equipment production and performance