

**THE UNIVERSITY OF WESTERN ONTARIO
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**CEE 9523b ENVIRONMENTAL GEOTECHNIQUE
2014- 2015 COURSE INFORMATION AND OUTLINE**

Course Summary: The course deals with land and resource utilization by humans in relation to geology, mineralogy, physico-chemistry and geotechnical properties of component soils and rocks. It discusses a number of topics including: cation exchange reactions and effects of pollutants on soil properties; formation and mitigation of acid rock drainage; contaminant transport modelling and applications to barrier design; erodability of soils in relation to moisture content, mineralogy, climate and attack by moving water; mineral-water interactions; solutions equilibria and geochemical modelling.

Instructor: Dr. E. K. Yanful E-mail: eyanful@uwo.ca

COURSE OUTLINE AND LECTURE SCHEDULE

| Date | Topics |
|-------------|---|
| January | Clay mineralogy-structural components, abbreviated classification of clay minerals. |
| February | Determination of soil composition - sample preparation, analytical methods, x-ray characteristics of clay minerals, quantitative analysis. |
| February | Soil colloid chemistry - clay water micelle, the double layer, sodium adsorption ratio, the nature of cation exchange, Gouy-Chapman and Stern theories of potential. |
| February | Reading/Conference Week (Feb 16-20). No Lectures. |
| February | Geotechnical and geoenvironmental implications of sulphide mineral oxidation - Heaving in black shale. Acid mine/rock drainage - theory, control strategies, liabilities, tailings dam geotechnique |
| March | Engineering properties of clay mineral groups. Soft clays of Canada. |
| March | Clay-leachate compatibility assessment - advective transport, hydraulic conductivity. |
| March | Clay-leachate compatibility assessment - diffusive transport. |
| March | Physico-chemical interactions between solvents and geologic materials. |

April Concrete attack by groundwater constituents.

April 8 Last Day of Class

EVALUATION:

Take-home exam 30%; Assignments 30%; Closed-book final examination 40%

RESOURCES:

- (1) Instructor's Course Notes (To be provided)
- (2) Reference Text: Fundamentals of Soil Behavior, 3rd Edition, 2005.
by James K. Mitchell and Kenichi Soga. John Wiley & Sons
- (3) Reference Text: Soil Physical Chemistry, 2nd Edition, 1998.
Edited by Donald L. Sparks, CRC Press.
- (4) Selected Journal Reprints by Yanful and Collaborators and Others (electronic copies and links will be provided).

ASSIGNMENTS SCHEDULE

| Assignment/Home Exam | Topic | Pick up Date | Due Date |
|-----------------------------|------------------------------------|---------------------|-----------------|
| Take-Home Exam | Quantitative clay mineral analysis | Feb 10, 2015 | Feb 24, 2015 |
| Assignment #1 | Water cover design & analysis | Mar 3, 2015 | Mar 10, 2015 |
| Assignment #2 | Contaminant transport modelling | Mar 24, 2015 | Mar 31, 2015 |

Note: All work must be picked up from and handed to Cindy (SEB 3010) by 4 p.m. of the pickup and due dates.

Dr. E.K. Yanful

January 2015