

Carleton University

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CIVE 5501 Advanced Foundation Engineering

Description: Review of methods of estimating compression and shear strength of soils. Bearing capacity and performance of shallow and deep foundations, pile groups, and use of in-situ testing for design purposes.

Objectives: To develop understanding of the concepts, theories and procedures of design for different types of foundations under static loadings.

TOPICS:

Subsoil Exploration:

- Subsoil exploration program
- Exploratory borings in the field
- Procedures for sampling soil
- Observation of water tables
- In-situ estimating compression and shear strength of soils
 - Vane shear test
 - Standard penetration test
 - Cone penetration test
- Geophysical exploration
- Interpretation of soil parameters for foundation design

Shallow Foundations:

- Introduction
- Ultimate Bearing Capacity of Shallow Foundations
 - General bearing capacity equation
 - Bearing capacity of non-uniform materials
 - Bearing capacity from correlation with SPT and CPT values
- Settlement of Shallow Foundations
 - 1D settlement theory
 - 3D settlement and elastic displacement theory
- Mat Foundations
 - Common types of mat foundations
 - Bearing capacity of mat foundations
 - Settlement of mat foundations

Deep Foundations:

- Introduction

- Load transfer mechanism in piles
- Effect of method of installation on pile performance
- Group effect in piles
- Piling Equipment and Installation
- Analysis and Design of Pile Foundations for Vertical Loads
 - Bearing capacity of single piles and pile groups
 - Settlement of single piles and pile groups
 - Design procedure for piles
- Analysis and Design of Pile Foundations for Lateral Loads
 - Ultimate lateral resistance of single piles and pile groups
 - Lateral deflection of single piles and pile groups
 - Design procedure for piles
 - Vertical piles subjected to eccentric and inclined loads
 - Limit state Analysis for pile foundation design

Special Topics

- Foundation design in permafrost

REFERENCE TEXT

- (1) Coduto, D., *Foundation Design: Principles and Practices*, Prentice-Hall.
- (2) Bowles, J., *Foundation Analysis and Design*, Fifth edition.
- (3) Das, B.M., *Principles of Foundation Engineering*, Seventh edition.
- (4) Canadian Foundation Engineering Manual, 4th Edition, BiTech Publishers, 2007

Evaluation: The final grade is arrived at as follows:

Project	20%
Assignments	30%
Final Examination	50%

Project: A design project will be assigned or critical review of some technical papers will be required.

Assignments: problems will be assigned and the solutions will be submitted towards the end of the term.

Course Instructor: Dr. M.T. Rayhani mohammad.rayhani@carleton.ca

“The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your **Letter of Accommodation** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (*if applicable*). “