Construction & Building Engineering Courses (CB)

Geotechnical Engineering Courses Group

CB 462 – Soil Mechanics

COURSE INFORMATION

Course Title: Soil Mechanics

Code: CB 462

Hours: Lecture – 2 Hrs. Tutorial – 2 Hrs. Laboratory – 2 Hrs.
Credit –3.

Prerequisite: CB 361

GRADING

Class Performance/Attendance:	10%
Midterm # 1/Assignments – (7^{th} Week):	30%
Midterm # 2/Assignments – (12^{th} Week):	20%
Final Exam:	40%

COURSE DESCRIPTION

Seepage. Effective stress. Vertical stresses. Consolidation and settlement. Shear strength. Slope stability. Lateral earth pressure. Compaction. Bearing capacity. Experimental determination of soil properties: Grain size distribution, Atterberg limits, Density and Compaction, Permeability, Shear strength, Consolidation, Bearing Capacity, In situ Testing and Sampling. Soil report writing.

TEXT BOOK

Principles of Geotechnical Engineering by DAS, Braja M., Publisher: Brooks-Cole, USA 2010.

Egyptian Code of Practice for Foundation and Soil Mechanics, Code No. 203/2007

REFERENCE BOOKS

Basic Soil Mechanics by WHITLOW Publisher: Longman, 3rd Edition 1995.

Soil Mechanics: Principles and Practice by BARNES, G. E., Publisher: McMillan, London, 1995

Soil Mechanics by CRAIG, R. F., Publisher: Chapman and Hall, 5th Edition 1992

Advanced Soil Mechanics by DAS, Braja M. Publisher: Taylor & Francis, Washington, 2nd Ed. 1997

Soil Mechanics Laboratory Manual by DAS, Braja M. Publisher: Engineering Press, 1997

Slope Stability and Stabilization Methods by ABRAMSON, Lee, Sharma and Boyce, Publisher: Wiley, New York, 1996.

Solving Problems in Soil Mechanics by Sutton, Publisher: Longman, London, 2nd E. 1993

Design and Construction of Foundations, Egyptian Code for Soil Mechanics, Design and Construction of Foundations, 1st Edition, 10 Volumes, Al-Ahram Press, 2001.

Geotechnical Engineering: Soil Mechanics by CERNICA, John N., Publisher: Wiley, New York, 1995.

Experimental Soil Mechanics by BARDET, Jean-Pierre Publisher: Prentice Hall, New York, 1997.

COURSE AIM

The course aims at introducing the student to the fundamentals of soil mechanics as a basis for the design, analysis and construction of retaining structures and foundations.

SPECIFIC OUTCOMES OF INSTRUCTION

- The student should be able to Identify the physical properties of soil and the relevance of these properties as they affect soil strength, compressibility, stability and drainage.
- The student should be familiar with the laboratory and in situ experimental determination of the physical and mechanical characteristics of soils is an integral and pivotal component of the course.

COURSE OUTLINE

Week Number 1-2: Seepage:

- Seepage forces, quick condition, elements of flow net theory
- Flow nets for two-dimensional flow, determination of seepage quantity from flow nets, seepage through earth dams

Week Number 3-4: Stresses in soils:

- Total and effective stresses, seepage and effective stress, distribution of pressure from point load, Boussinesq's equations, uniformly loaded circular area
- Pressure caused by uniformly loaded rectangular area, pressure caused by embankment load, Newmark's influence chart, approximate estimate of vertical stress

Week Number 5: Consolidation and settlement:

- Compressibility of soil, one-dimensional consolidation, mechanical analogy model, load-deformation characteristics of soils, one-dimensional consolidation theory

Week Number 6: Consolidation test:

- Determination of coefficient of consolidation cv, log-time and root-time methods, one-dimensional consolidation test, secondary compression

Week Number 7: Settlement of soils:

- Immediate (elastic) settlement, settlement predictions based on one-dimensional consolidation, settlement during construction, total and differential settlements, tolerable settlements in buildings

Week Number 8: Shear strength of soil:

- Mohr's theory of failure, determination of the shear strength of cohesionless and cohesive soils, factors affecting shear strength, in situ evaluation of shear strength

Week Number 9: Stability of slopes:

- Infinite slopes, the circular arc analysis, ordinary method of slices, Bishop's simplified method, semi-graphical approximation

Week Number 10: Stability of slopes:

- Stability charts, Cousin's approach for simple slopes, sliding on inclined plane; liquefaction, seismic effects and drawdown

Week Number 11: Lateral earth pressure:

- Active and passive earth pressures, Rankine's theory for level and inclined surfaces, Coulomb's equation

Week Number 12: Lateral earth pressure:

- Lateral earth pressure in partially cohesive soils, unsupported cuts in (c-ϕ) soil, effect of surcharge loads, Culmann's method

Week Number 13: Compaction:

- Standard and modified Proctor tests, field equipment, performance control, in-place field tests, compacted clays, vibratory compaction

Week Number 14: Bearing capacity:

- Bearing failure patterns, Prandtl's theory for ultimate bearing capacity, bearing capacity theory of Terzaghi, Meyerhof & Hansen

Week Number 15: Bearing capacity of shallow foundations:

- Effect of water table, bearing capacity based on standard penetration tests; compressible, collapsible and expansive formations

Week Number 16: Final Exam.

Laporatory Experiments:

Week Number 1: Site exploration: design, implementation, methods and equipment

Week Number 2: Determination of the unit weight of fine-grained soil

Week Number 3: Determination of water content: coarse- and fine-grained soil samples

Week Number 4: Determination of the liquid and plastic limits of fine-grained soil:

Week Number 5: Casagrande apparatus, cone penetrometer apparatus

Week Number 6: Determination of the specific gravity of soil particles

Week Number 7: Grain size distribution: hydrometer analysis

Week Number 8: Determination of the coefficient of permeability: constant- and falling-head permeability tests

Week Number 9: Proctor test: standard and modified Proctor test, determination of the maximum dry unit weight and optimum moisture content (OMC)

Week Number 10: Determination of in situ unit weight: sand cone method, balloon method

Week Number 11: Determination of shear strength parameters: direct shear test

Week Number 12: Determination of cohesion for fine-grained soil: unconfined compression test

Week Number 13: Determination of cohesion for fine-grained soil: pocket shearmeter, pocket penetrometer

Week Number 14: Consolidation test: test setup and data acquisition

Week Number 15: Consolidation test: data processing, test result interpretation

Week Number 16: Professional soil report: types, contents, conclusions

COURSE COORDINATOR AND DEMAND

Course Coordinator: Dr.sameh Abu El Soud.

Course Demand: *Required*