Soil Mechanics

Instructor: Dr. M.R. Mosaddeghi

Objectives of the course:

The course deals with the basic concepts in soil mechanics: soil phases' relations, particle size distribution, plasticity, soil mechanical properties and processes, soil strength and the reaction of soil when it is subjected to stresses. This course considers these processes by way of developing a detailed understanding of the response of soils to imposed stresses and their resulting deformations and modes of failure. Theories should be applicable for agricultural purposes, mainly: compaction, tillage, traction and root growth. Special attention is given to the difficulties in applying classical soil mechanics (for engineering purposes) in agriculture, and in methodological problems.

Course contents:

1) Basic soil phase properties and relations
2) Particle size distribution
3) Soil plasticity, atterberg limits, and their applications
4) Soil stress-strain (constitutive) relations, soil strength
5) Stress and strain tensors
6) Effective stress theory
7) Mohr-coulomb theory
8) Unsaturated soil mechanics
9) Soil strength's measurements
10) Soil shear strength and applications
11) Soil penetrability and applications
12) Soil tensile strength, soil crumbling, soil friability and applications
13) Soil consolidation and compaction, pre-consolidation and pre-compaction stresses
14) Soil compactibility, Proctor test and applications
15) Soil compaction and tillage
16) Stress distribution in soil

Lab

1) Particle size distribution
2) Atterberg limits
3) Compaction (Proctor) test
4) Water permeability test
5) Unconfined compression test
6) Uni-axial confined compression test
7) Tri-axial test
8) Direct shear test
9) Soil consolidation/compression test
10) Tensile strength test
11) Soil penetrability test

Projects:

1) Strength of unsaturated (agricultural) soils
2) Soil friability and its application in soil tillage
3) Mechanics of root growth and modeling
4) Models of soil compaction
5) Applications of penetration resistance in soil compaction and tillage

Scientific Sources:

Books:

Textbooks on Soil Mechanics and Soil Geotechnical Properties:

1) Terzaghi, K. 1943. Theoretical Soil Mechanics. John Wiley & Sons Inc., New York, 510 pp.

2) Terzaghi, K., and R.B. Peck 1967. Soil Mechanics in Engineering Practice. John Wiley & Sons Inc., New York, 592 pp.

3) Lambe, T.W., and R.V. Whitman. 1969. Soil Mechanics. John Wiley & Sons Inc, New York, 553 pp.

4) Bowles, J.E. 1979. Physical and Geotechnical Properties of Soils. McGraw-Hill Book Company. 492 pp.

5) Bowles, J.E. 1978. Engineering Properties of Soils and Their Measurement. Second Edition, McGraw-Hill Book Company, New York, 213 pp.

6) Fredlund, D.G. and H. Rahardjo. 1993. Soil Mechanics for Unsaturated Soils. John Wiley & Sons, Inc. 517 pp.

7) Koolen, A.J., and H. Kuipers. 1983. Agricultural Soil Mechanics. Advanced Series in Agricultural Sciences. Vol. 13, Springer-Verlag, Berlin. 241pp.

8) McKyes, E. 1989. Agricultural Engineering Soil Mechanics, Elsevier, Amsterdam.

9) Gill W.R. and G.E. Vanden Berg. 1968. Soil Dynamics in Tillage and Traction Agricultural Handbook No. 316 Agricultural Research Service USDA.

10) Glinski, J., and J. Lipiec. 1990. Soil Physical Conditions and Plant Roots. CRC Press. 250pp.

Journals:

Soil Science Society of America Journal
Soil Science
European Journal of Soil Science (former name: Journal of Soil Science)
Soil & Tillage Research
Soil Use and Management
Soil Technology
International Agrophysics
Transactions of ASAE
Canadian Geotechnical Journal
Geotechnique
Journal of Terramechanics
Journal of Geotechnical and Geoenvironmental Engineering