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| <p>The Hashemite University Faculty of Natural Res. & Environ. Dept. Land Management & Environ. First Semester, 2011/2012</p> |  | <p>Dr. Mohammed I. Al-Qinna qinna@hu.edu.jo Eng. Properties of Soil (1202417) 3 Credit Hours</p> |
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Course Objectives:

- Introduce the students to the main concepts and theories of soil physical properties from the engineering stand point in order to evaluate, judge and amend the soil for various environmental, agricultural, and engineering applications.
- Provide the students with the applications of solid and fluid mechanics to formulate the basic techniques used for evaluation soil properties and to develop the methodologies required for site improvement and testing the soil for various foundation establishments.
- Introduce the students to the geotechnical engineering concepts and soil mechanics as a combination of engineering mechanics.
- Provide the students with the major determination principles used either at the field or the laboratory for the major soil physical properties used by engineers.

| Course Outline | Week |
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| <p>Introduction Definitions, scope of engineering, soil engineering history, origin of soils, formation of soils, transportation of soils</p> | 1 |
| <p>Volume and Mass Relationships Soil as a three-phase system, soil fractions, void ratio, porosity, degree of saturation, percentage of air voids, air content, water content, bulk mass density, dry mass density, saturated mass density, submerged mass density, mass density of solids, volume-weight relationships, specific gravity, relation between void ratio and water content, relation between mass density and water content, relation between percentage air void ratio and dry mass density, examples.</p> | 2+3 |
| <p>Soil-Water Content Properties of water, types of water, surface tension, capillary rise in small diameter tube, capillary tension, capillary rise in soil, soil-water determination methods, soil-water potentials, soil moisture characteristic curve, hysteresis.</p> | 4+5 |
| <p>Soil Particle Analysis Introduction, particle size classification systems, specific surface, textural classification triangle, the importance of soil texture, flocculation and dispersion, mechanical analysis methods and procedure (sieve analysis, sedimentation analysis), Stock's law and his assumptions, particle-size distribution curve, uniformity coefficient, coefficient of curvature, soil classification (Unified and AASHTO classification system), group index, and soil relative density.</p> | 6+7 |
| <p>Plasticity Characteristics of Soils Viscosity, swelling, soil consistence (cohesion, adhesion, friability, plasticity), Bingham equation, soil plasticity, consistency limits, liquid limit, plastic limit, shrinkage limit, shrinkage parameters, Atterberg limit, methods of measuring the soil consistence, liquidity, consistency indexes, flow index, toughness index, sensitivity, thixotropy, activity of soils, examples.</p> | 8+9 |

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| Soil Structure Soil structure, classification of soil structure, types of clay minerals, isomorphous substitution, determination methods of clay minerals, Bragg's Law, clay minerals and their behavior, on exchange, hydration and swelling, flocculation and dispersion, aggregate stability, soil crusting, soil conditioners. | 10+11 |
| Stress in Soil and Shear Strength Introduction, stress due to surface loads, Boussinesq equation, soil strength, shear strength, modules of soil rupture, penetrometer, stress at a point, Mohr circle, angle of obliquity, failure of soil. | 12+13 |
| Compaction of Soils Introduction, compaction objectives, theory of compaction, compactive effort, standard and modified Proctor test, compaction curve, factors affecting compaction, effect of compaction on properties of soils, methods of compaction used in fields, compaction versus consolidation, compaction control | 14+15 |

Textbook:

McCarthy, D.F. Essentials of Soil Mechanics “Basic Geotechnology”. 2002. 6th Edition, Prentice Hall, New Jersey.

Books:

1. Bowles, Joseph E. Engineering Properties of Soils and Their Measurement, 4th Edition, McGraw-Hill, 1992.
2. Arora, K.R. Soil mechanics and Foundation Engineering. 2000. Fifth Ed. Standard Publisher Distributors, Delhi.
3. Hillel, D. 1980. Fundamentals of soil physics. Academic Press, New York, USA.
4. Whitlow, R. Basic Soil Mechanics. 1998. Third Ed. Wesley Longman, England.
5. Liu, C. and Evett J.B. Soil properties: testing, measurement, and evaluation. 2000. Fourth Ed. Prentice Hall. New Jersey, USA.
6. Kezdi, A. Handbook of soil Mechanics: soil testing. 1980. Elsevier Scientific Publishing Company. Amsterdam.

Homeworks:

Homeworks will be assigned week ahead from the due time. Penalties are restrictedly considered.

Drop Quizzes:

There will be a short quiz at the beginning of some lectures consisting of 1 to 3 brief questions.

Evaluation:

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| First Hour Exam | 20% |
| Second Hour Exam | 20% |
| Assignments | 10% |
| Final Hour Exam | 50% |