The University of Iowa

Department of Civil & Environmental Engineering

SOIL MECHANICS 53:030

Fall Semester 2005

Preview of First Midterm Examination

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The first midterm exam is scheduled to be given on Wednesday, October 19th at 7:00pm. The exam period is two hours long, and will be used to examine you on the material covered since the start of the semester. The exam format will include both short answer questions, and problem solving questions. The exam will be closed book, closed notes, but you are permitted to bring in one formula sheet. On the formula sheet, you can write down basic relations that are difficult to memorize and which may be needed in solving problems. **You are not permitted, however, to have solved problems written down on your formula sheet.** You will be requested to hand in your formula sheet with your exam, and it will be returned with your graded exam. Please make sure that your name is on your formula sheet.

To prepare for the exam, you should become thoroughly familiar with the issues outlined below. Once you've studied for the exam by reviewing the topics listed below, you may want to test your readiness by attempting the sample exams available on the course web-site. Ideally, it is recommended that you begin studying at least one week prior to the exam so that you will have time to consult with the instructor or TA's about questions and unclear concepts. [Answers to the practice exams are not provided to you or posted anywhere, so if you want to check your answers, compare your results with those of other students. If you visit the course instructor or the grading TA, they will tell you whether or not your work looks reasonable.]

Mass, Volume, Void Ratio, Saturation Relations

- Know such definitions as void ratio, porosity, saturation, water content, dry density, saturated density, specific gravity, etc.
- Know how given some soil information (void ratio, porosity, saturation, water content, etc) you can generate additional information using basic definitions.
- Know about relative densities of soils.

Soil Types

- Know the basic soil types (gravels, sands, silts, clays) and what the fundamental differences are between these soils.
- Be very familiar with the idea of specific surface area of soils and how this changes with the grain sizes of soils. Also be able to explain how SSA affects the permeability of soils.
- Know about grain size distributions for soils, and how you would measure them. Also know the difference between well-graded, and uniform soils.
- Know about Atterberg limits for soils, and what they measure.
- Also, know what the liquidity index is for fine-grained soils.
- Know about the potential dangers of loose soil deposits.
- Be familiar with the different soil classification systems.

Fluid Flow in Soils

- Know about Bernoulli head and how it measures the energy of fluid in soils.
- Understand Darcy's Law (both the one-dimensional and multi-dimensional forms), and know how to apply it.
- Know what discharge and seepage velocities are and how they are related.
- Understand permeabilities of soils, how they are measured, and what factors influence soil permeability.
- Know the continuity equation for fluid flow in soil and how to apply it.
- Know about flows through layered soils.
- Know how to draw good flow nets for two-dimensional seepage problems, and know how to utilize all of the information that flow nets provide.
- Know how to calculate fluid pressures in soil, both when seepage is not occurring, and when seepage is occurring.
- Know about draw-down of the water table from pumping wells and how to apply appropriate formulas.

The Effective Stress Concept

- Understand the relationship between total stresses, effective stresses, and pore pressures (or neutral stresses).
- Know what effective stresses actually represent physically.
- Be able to calculate total stresses, effective stresses, and pore pressures when no seepage is occurring.
- Be able to do the same when seepage is occurring.
- Understand, and be able to calculate seepage forces exerted by fluid on the soil skeleton.
- Understand how and why liquefaction of soils can occur.
- Be able to calculate factors of safety against heave around hydraulic structures.