FE 316 – Soil Mechanics

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Optional Text: Principles of Geotechnical Engineering, 4th through the 7th edition Braja M. Das, Brooks/Cole, 2002/2006.
OR,
Geotechnical Engineering: Principles and Practices, Donald P. Coduto, Pearson.

Course Goal

The Goal of this course is to provide Forest Engineers, Ecological Engineers and Civil Engineers with a working knowledge of the classical soil mechanics that is the basis for basic slope stability analysis, retaining wall and anchor design, and bearing capacity.

Course Learning Objectives

Elements of soil mechanics can be traced back to the 1700's, and the subject is growing all the time. Latter day developments are quite complex, and often do not have very broad application in day to day engineering practice. However, there are a few classical analyses that are the foundation of soil mechanics, without which no Forest Engineer or Civil Engineer should leave the University. The learning objectives for this course are built around preparation for everyday practice as a Forest Engineer or Civil Engineer, and preparation for further coursework in geotechnical engineering, that branch of engineering dedicated to the use of earth materials as a part of civil works. The specific learning objectives are:

1. **A basic understanding of soil strength and its application to classical soil mechanics. (ABET outcomes: a)**
2. **The ability to determine the stability of an engineered or natural earth slope. (ABET outcomes: a, b, e, g, k, o)**
3. **The ability to design stable slopes in situations of moderate geotechnical difficulty. (ABET outcomes: a, b, e, g, k, o)**
4. **The ability to compute lateral earth pressures for retaining wall design purposes. (ABET outcomes: a, k)**
5. **The ability to compute passive resistance for anchor design purposes. (ABET outcomes: a, k)**
6. **The ability to design modest height retaining walls, and anchor blocks. (ABET outcomes: a, c, e, k, o)**
7. **The ability to compute bearing capacity for shallow spread footings. (ABET outcomes: a, e, o)**

The Starting Point

Nearly all engineering courses require some prerequisite knowledge and proficiency. The catalog listed prerequisites for FE 316 are CE 372 or FE 315. However, there is a rather lengthy prerequisite chain, which includes Statics (ENGR 211) and Strength of Materials (ENGR 213), that leads to the direct prerequisites for this course. All components of the courses in the prerequisite chain are not directly required for success in FE 316, but a few noteworthy ones are required. Listed below are knowledge, understanding, and skills that will be required for this course.

- Algebraic manipulation for the solution of complex equations.
- Geometry and trigonometry necessary for solution of triangles.
- Ability to draw free body diagrams.
- Ability to formulate the equations of static equilibrium.
- Ability to solve for shear and normal stresses algebraically given principle stresses in a body and vice versa.
- Ability to manipulate Mohr's circle for stress.
- Ability to compute static and flowing pore water pressure.

If you do not have these abilities, then you must either gain them during the term as they are needed, or drop back and take remedial course work to develop them!!

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Approximate Spring term 2014 schedule

The Exams will be on the dates shown for sure, lecture and recitation subjects will likely vary somewhat.

Week	Dates	Lecture	Recitation
1	Mar 31 – Apr 4	Course Introduction "Strength Review"	"Strength Review"
2	Apr 7 – 11	"Strength Review" Landslide mechanics and impacts Mechanics of wedge failures	"Strength Review"
3	Apr 14 – 18	Infinite Slope Mechanics Bishops Method for Circular Failures • Spread sheet computations	Site Visit / Computational Stability Analysis
4	Apr 21 – 25	Force Equilibrium for non-circular failures • Graphical method • Spread Sheet computations Wedge Failure and Infinite slope analysis • Spreadsheet computations	➢ **Midterm Exam on Soil Strength**
5	Apr 28 – May 2	Slope Stability Analysis Design of Stable Slopes	Slope Stability Project
6	May 5 – 9	Lateral Earth Pressures Rankine Earth Pressure Theory Coulomb Earth Pressure Theory	Slope Stability Project(Continued)
7	May 12 – 16	Design of Retaining Walls	Overturning analysis of gravity and cantilever retaining walls
8	May 19 – 23	Reinforced Earth Retaining Walls Reinforced Earth Retaining Wall Design	➢ **Midterm Exam on Slope Stability**
9	May 26 – 30	Memorial Day Holiday – May 27th Bearing Capacity Theory	Retaining Wall Design Activity
10	June 2 – 6	Course Review.	Bearing Capacity Computations
11	June 12th	Official Final Exam Date	

Homework and Report Policies

Homework serves a dual purpose in an engineering course. First, it provides the student with a learning experience, and second, it provides a ready reference for the young engineer to consult when faced with similar problems on the job. In this second role, homework assignments are similar to the job files that you will maintain whether your professional career is in private industry or with a public agency. Job files are used routinely as a reference on future projects that are similar to past projects, and your homework will find the same use, particularly in the first few years after you leave the University. Further, job files are a permanent record of the analysis and design decisions that were made on any project, hence, they may serve as documentation in legal proceedings that a particular design was done in accordance with the standard-of-practice. For these reasons, it is imperative that homework be laid out in a fashion that can be easily understood by the reader even years into the future. Preparing homework in this manner will also get you in the habit of properly documenting your work in for the job files when you leave the university.

1. **Homework should be done independently unless group effort is specifically indicated.**
2. Homework should be completed on engineering paper using one side only.
3. Page headings:

	Course Number	Date & Assignment #	Name	pg# / #pgs

4. Printing of a number of styles is acceptable for engineering work; **do not use cursive writing.**
5. Problems should be stated or referenced.
6. **Assumptions should be stated where made.**
7. **Written documentation with references should accompany all computations, judgments, etc.**
8. **Spreadsheet computations must include documentation of cell formulas used; this should be done as a part of the spreadsheet.**
9. Solutions should be clearly labeled showing the appropriate units.
10. Care should be taken to show numerical results with only the proper number of significant figures.
11. Illustrations and graphs should be carefully drawn using drafting aids (either computer or hand drawn), and completely labeled.
12. Returned homework assignments should be maintained in an organized homework file that also contains any supporting papers or documents.
13. Any incorrect problems should be reworked, and the revised solutions placed in the homework file along with the original work. (I may check on this periodically!)

Course Grading

Homework and report grading will be partitioned between (1) Professionalism and Ethics, (2) Documentation of the work, and (3) Correctness of the solution.

Each homework assignment will be grading according to the following percentages:

Professionalism and Ethics		15%
Documentation of work		15%
Correctness		70%
	Total	100%

A significant degree of latitude will be granted for work on examinations, since they have time and other constraints that will preclude thorough documentation and referencing. However, to the degree practicable, documentation on exams will support the correctness of the solution method in cases where the numerical solution is incorrect.

Grade Distribution

Homework and Recitation Problems		20%
Participation		5%
Slope Stability Project		20%
Midterm Exams		30%
Final Exam		25%
	Total	100%

Note – The Homework and Projects will be graded very critically. These two work items are worth 40% of the course grade. If you do not do an adequate job of documenting your work, professionally presenting it, and obtaining correct solutions, you will have difficulty performing well in this class.

Note – Participation will be evaluated from answering questions, asking questions, in-class exercises and the occasional unannounced quiz.