SCOPE: This course covers the structural design of foundations. Designs will include steel base plates, concentrically loaded spread footings (reinforced and unreinforced concrete wall, square, rectangular) eccentrically loaded spread footings (square, rectangular, combined) mat foundations, grid foundations, retaining walls and abutments, piles and pile caps, flexible earth retaining structures, caissons, and other topics as time permits.

TEXTS:
Das, Braja M., Principles of Foundation Engineering, 7th edition, Thomson, Toronto, 2011. (optional, but a very useful reference)
AISC *Steel Construction Manual*, 13th Edition, 2005
ACI 318-08 *Building Code Reqmts for Structural Concrete*, 2008
MacGregor and Wight, *Reinforced Concrete: Mechanics and Design*, 4th Edition, Prentice Hall, 2004
Fisher, J.M. and L.A. Kloiber, *Base Plate and Anchor Rod Design*, 2nd edition, AISC Design Guide 1, AISC, 2006
Course Pack, Fall 2010, from Engineering Copy Center

INSTRUCTOR: J.A. Laman, 231J Sackett Bldg., 863-0523, jlaman@psu.edu
Office Hours: M and W, 1:30 to 3:00 pm or by appointment

LECTURES: MWF, 9:05 am to 9:55 am, Room 205 S. Henderson
See the included *Attendance Policy*

DESIGN PROBLEMS: Weekly design problems will be assigned throughout the semester. Problems will be graded and solutions posted on the ANGEL website.

QUIZZES Several in-class quizzes will be administered throughout the semester as each topic is concluded.

ENGINEER'S NOTEBOOK At the conclusion of the semester, each student will submit a well organized notebook summarizing the course notes, handouts, design problems, quizzes, reference materials, and other pertinent information. See the included *Engineer's Notebook Guidelines*. In addition, a near mid-semester check of Notebook progress may be required if students are not maintaining the NB.

GRADING: The course grade will be based on (detailed requirements next page):

5%	- Attendance
50%	- Design Problems
40%	- Quizzes
5%	- Engineer's Notebook
100%	- Total

A detailed explanation of the course grading policy is provided in the included *CE441 Course Grading Policy*

ATTENDANCE POLICY

Regular and full attendance is critical to student success in this course. All absences are treated the same, regardless of reason unless there is an extremely severe and compelling issue. Exceptional cases must be discussed in person with the instructor. Cronic tardiness will be evaluated on a case-by-case basis.

a. 0 to 2 absences = 5% earned
b. 3 absences = 4% earned
c. 4 absences = 3% earned
d. 5 absences = 2% earned
e. 6 absences = 1% earned
f. 7 absences = 0% earned

Absences will be recorded on the angel website and should be monitored by each student. It is the student's responsibility to confirm the accuracy of the attendance record. Students absent for ANY reason for more than 10 class periods will automatically receive an incomplete for the semester.

DESIGN PROBLEMS

Design problems will be assigned on a regular basis to be submitted for grading. Problems will require the application of recent class lectures and reading. It is expected that all assigned design problem solutions will represent an individual student effort; however, study groups are acceptable and encouraged.

QUIZZES

Several short, in-class quizzes will be administered during the semester. Quizzes will evaluate student understanding of recent and previous lectures, class discussions, and reading. All quizzes will be open book, open notes with response provided on standard engineering paper in pencil only. Students who attend all class sessions, take careful notes, complete reading in a timely fashion, and complete design problems independently and methodically will successfully answer quiz questions. No make-up quizzes will be provided.

COURSE GRADING POLICY

Quizzes and design problems will vary in difficulty, therefore, it may be necessary to adjust raw scores to account for this variability. The adjusted mean for this course and all assignments will be the center of the standard university grading scale range for a "B-" (81.50%). Exception to this adjustment: if the raw mean score is greater than 81.50%, students keep their raw scores – scores will never be adjusted downward. The standard university grading scale is as follows:

93.00 to 100	A	
90.00 to 92.99	A-	
87.00 to 89.99	B+	
83.00 to 86.99	B	
80.00 to 82.99	B-	(adjusted course average = 81.50%)
77.00 to 79.99	C+	
70.00 to 76.99	C	
60.00 to 69.99	D	
0.00 to 59.99	F	

Petitions for instructor review of graded assignments must be made within 48 hours of return of the submittal. After 48 hours, the grade stands, regardless of the circumstances.

ENGINEER'S NOTEBOOK GUIDELINES

1. A typed cover page on the outside of the binder containing course number, course title, semester, student name, instructor, Penn State University
2. Typed course number, course title, and student name on the spine
3. Overall table of contents, identifying each section by lecture topic and any appendices
4. Table of contents for each tabbed section:
    - Table of Contents
    - Course Administration/Outline
    - Soil Mechanics Review
    - Base Plate Design Axial
    - Base Plate Design Moment
    - Concrete Design Review
    - Pedestal Design
    - Wall Footings
    - Square Spread Footings
    - Rectangular Spread Footings
    - Footings with Moment
    - Combined Footings
    - Strap Footings
    - Mat Footings
    - Piles and Pile Caps
    - Concrete Retaining Walls
    - Sheet Pile Retaining Walls
    - And others, time permitting
    - **Homework (must be in separate, tabbed section and <u>corrected</u>. Electronic solutions must be printed and inserted in the section)**
    - Quizzes (must be in separate, tabbed section and corrected)
5. All pages numbered (except homework and quizzes)
6. All submitted work must be laser printed or hand written in pencil on engineering paper only. Never take any notes on anything other than engineering paper.
7. All notebook sections tabbed with professional, commercially available tabs
8. All homework and quizzes containing errors marked by the grader must be corrected with RED colored pencil or RED colored pen. Major corrections should be completed on a new sheet of engineering paper with "**HW# xx CORRECTIONS**" as heading and done with a normal pencil.
9. Computer programs must be included on CD with clearly described user instructions and sample output on the CD.
10. All electronically available information and references must be included on CD.
11. The CD must be enclosed in a plastic, 3-ring binder sleeve (not loose or in binder pocket)
12. **Final Engineer's Notebooks are to be submitted in 231J Sackett before 10:00 am, Tuesday, December 7, 2010. Late submissions will not be accepted under any circumstances.**
13. Engineer's Notebooks may be retrieved outside 231J Sackett between 9:00 am and 12:00 pm Wednesday, December 8, 2010.
14. Notebooks not retrieved by 4:00 pm Friday, December 10 can be collected at a later, prearranged date.

CE 441 – STRUCTURAL DESIGN OF FOUNDATIONS

Course Outline – Fall 2010

The Pennsylvania State University
Dept. of Civil and Environmental Engineering

Topic	**Reading**
Introduction	
Geotechnical vs Structural	Class notes and discussion
Review of Ultimate Bearing Capacity	CE335; CE435; Das, Ch. 3
Review of Structural Concrete Design	ACI 318-05: Ch. 7, Ch. 10, Ch. 11, Ch. 12
Steel Column Base Plates	AISC pg 14-4 to 14-11; AISC Steel Design Guide 1, 2nd edtion, ACI App. D
Concrete Column Pedestals	ACI Ch. 15
Design of Continuous Wall Footings	ACI Ch. 15
Individual Column Footings	MacGregor and Wight or other concrete design text
Design Procedures	Hassoun, Ch 13
Critical Sections	
Reinforcement	
Design of Footings Subject to Moment	Hassoun, Ch 13
Resultant within Middle Third	Course notes and discussion
Resultant outside Middle Third	
Moment about both Axis	
Design of Combined Footings	Hassoun, Ch 13, McCormac and Nelson Ch 12
Rectangular	
Trapezoidal	
Cantilever	
Load Combinations	
Analysis and Design of Raft/Matt Foundations	Das Ch 6, Bowles Ch 10, and Caduto Ch 10
Design of Pile-Supported Foundations	Class notes and discussion
Individual Column Foundations	
Foundations Subject to Moment	
Design of Concrete Retaining Walls and Abutments	Das Ch 8, Hassound Ch 14, McCormac and Nelson Ch 13
Proportions	ACI Ch 14
Forces and Load Combinations	
Earth Pressure	
Wall Reinforcing Requirements	

Design of Flexible Earth-Retaining Structures – Sheet Piling	Das Ch 9, Coduto Ch 25, and Bowles Ch 13.
Behavior	Course notes and discussion
Cantilevered Walls in Sand	AISC Part 16, Ch F, J
Cantilevered Walls in Clay	
Anchored Walls (Bulkheads)	
Wale, Tie, and Anchor Design	
Design of Drilled Piers/Caissons	

References:

Bowles, Joseph E., *Foundation Analysis and Design*, 5th Edition, McGraw Hill, NY, 1996, ISBN: 0-07-912247-7.

Coduto, Donald P., *Foundation Design: Principles and Practices*, 2nd Edition, Prentice Hall, Upper Saddle River, NJ, 2001, ISBN: 0-13-589706-8.

Das, Braja M., Principles of Foundation Engineering, 7th edition, Thomson, Toronto, 2011.

Fisher, J.M. and L.A. Kloiber, *Base Plate and Anchor Rod Design*, 2nd edition, AISC Design Guide 1, AISC, 2006.

MacGregor and Wight, *Reinforced Concrete: Mechanics and Design*, 4th Edition, Prentice Hall, 2004 ISBN-13: 9780131429949

Hassoun, Nadim M., and Al-Manaseer, Akthem, *Structural Concrete: Theory and Design*, 3rd Edition, John Wiley and Sons, Hoboken, NJ, 2005 ISBN: 0-471-69164-X.

McCormac, Jack C., and Nelson, James K., *Design of Reinforced Concrete*, 7th Edition, John Wiley and Sons, Hoboken, NJ, 2006 ISBN: 0-471-76132-X.

Nawy, Edward G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Pearson Prentice Hall, Upper Saddle River, NJ, 2005 ISBN: 0-13-149757-X.

Nilson, A. H., Darwin, D., Dolan, C. W., *Design of Concrete Structures*, 13th Edition, McGraw Hill, NY, 2004, ISBN: 0-07-248305-9.

Peck, R. B., Hanson, W. E., Thornburn, T. H, *Foundation Engineering*, 2nd Edition, John Wiley and Sons, NY, 1974, ISBN: 0-471-67585-7.