PENN STATE UNIVERSITY

Department of Civil and Environmental Engineering

CE 341 – Design of Reinforced Concrete Structures

Course outline

Course objective: The objective of this course is to introduce students to the design and analysis of reinforced concrete structures. This will be achieved through explaining the main characteristics of concrete as a structural material, introducing students to the principals of reinforced concrete mechanics, explaining the design process of reinforced concrete elements subjected to different types of loads, and familiarize students with codes and specifications related to the design of reinforced concrete structures.

Catalog Data: **3 Credits:** Design of reinforced concrete beams, slabs, and columns, with emphasis on ultimate-strength methods; prestressed concrete; building and bridge applications, Prerequisite: C E 340. Prerequisite or concurrent: C E 336.

Textbooks: 1) James Wight "*Reinforced Concrete: Mechanics and Design,*" 7th Edition, Prentice Hall

2) ACI 318-14 "*Building Code Requirements for Structural Concrete and Commentary (ACI 318R-14),*" American Concrete Institute, Farmington hill, MI.

Instructor: Dr. Hassan El-Chabib, P. Eng.
206F Sackett Building
Email: helchabib@Engr.psu.edu

Office hours: There will be no assigned office hours for this course. Students are encouraged to communicate with the instructor via email (helchabib@engr.psu.edu) and every effort will be made to provide a response within 24 hours. Please use the following guidelines for seeking course assistance:

- Short questions – email text format is generally sufficient to formulate the question and response.
- Complex questions – attach an image, drawing, or figure to the email requesting assistance, use PDF format.
- Consultation with the instructor via phone or video/voice by appointment.

Grading Scheme:

Assignments/Quizzes	25 %
Midterm-Exam	35 %
Final Exam	40 %

Grading scale:

93.00 - 100.00	A	77.00 - 79.99	C^+
90.00 - 92.99	A^-	70.00 - 76.99	C
87.00 - 89.99	B^+	60.00 - 69.99	D
83.00 - 86.99	B	00.00 - 59.99	F
80.00 - 82.99	B^-		

Assignments: Assignments (reading/homework) are deemed to be very critical to understand the materials covered in this course. **Solutions must be neatly organized using engineering papers with your name, HW # and date on the top of each page**. All student solutions are to be submitted electronically in PDF format, black and white or gray scale (no color), in a single file, **with file size not to exceed 1MB** – adjust the scan resolution as required – gray scale and 200 dpi is sufficient. The following file naming convention will be strictly enforced:

LASTNAME_341_HW#.PDF, for example: **SMITH_341_HW1.PDF**

Upload the single PDF file to Canvas in the corresponding assignment by the deadline provided. Files not meeting the above file naming convention will be rejected. Late homework will not be accepted. Each student is responsible for ensuring that the HW problem file has been correctly submitted.

Exams: One midterm exam **(June 6-8, 2018**) and a comprehensive final exam (**June 20-22, 2018**) will be administered during the semester.
Each student is required to secure a proctor for this course, finish a quiz (to be posted on the course website) providing the proctor information, and submit for approval **no less than one week prior to each examination**. Students who do not submit the proctor information by the assigned due date will receive a **ZERO grade** for that examination.

Notes:

1. The proctor's e-mail address must be a business/government e-mail. Any e-mails ending in yahoo.com, gmail.com, hotmail.com, or other similar web-based e-mail addresses are not acceptable.
2. If you have any question regarding access to the course website or having technical difficulty viewing the materials posted on the course website, contact the office for Digital Learning using the contacts bellow

   Office for Digital Learning
   College of Engineering
   301-A Engineering Unit C
   The Pennsylvania State University
   University Park, PA 16802
   Phone: 814-865-7643
   E-mail: odl@engr.psu.edu

No make-up examinations or alternate times from that listed will be provided –registering for this course constitutes a contract to meet all requirements as specified herein.

Examination Instructions – Proctor and Student

1. Proctored examinations must be completed within one, 2:00:00 hour time period – no additional time is to be provided by the proctor or requested by the student.
2. The 2:00:00 hour time period must be mutually agreed upon between the student and the proctor and be within the allotted examination days.
3. Any item or reference not explicitly permitted by these instructions is to be considered prohibited from the examination room.
4. The ACI318-14 code (or part of) is permitted in the examination room.
5. Note materials that were accumulated as a direct result of this CE341 course (**excluding worked-out examples)** are permitted in the examination room.
6. Scientific, non-programmable calculators are permitted in the examination room. Computers or other programmable devices are strictly prohibited.
7. Cell phones, iPads, tablet PCs or any other communication device or internet access capable device of any type are not permitted in the examination room.
8. Backpacks of any type are not permitted in the examination room.
9. Examination solutions must be submitted on standard engineering paper, in pencil, double spaced.
10. The completed examination is to be immediately submitted in person by the student to the proctor at the conclusion of the 2:00:00 time period. The proctor must:

    a. Scan the original examination and upload to the course website on Canvas
    b. Secure the original examination until receipt of the scanned/uploaded examination
    c. Destroy the examination student solution.

Examination Instructions – Student

1. Provide an organized, neat, and legible solution in pencil on engineering paper.
2. Double space the solution to allow for grading comments.
3. Present no more than 3 significant figures for final results.
4. Write your initials and page number in the upper right corner of each solution page.
5. Staple the examination sheet and solution together, examination sheets on top,
6. Show all calculations and identify each step for credit. Clearly state and justify all assumptions.

ADHERENCE TO COURSE REQUIREMENTS

Because this is a web-based course and there are no class meetings, it is extremely important that every student accept the responsibility of learning and adhering to course requirements. The administration of an online course involves detailed requirements for communication, submittal of work, execution of examinations, adherence to a schedule, completing all reading assignments, and viewing all video lectures in addition to an intellectual commitment to learn the course material. It is each student's responsibility to read and understand all course requirements and follow them.

COMPUTER FACILITIES

Each student must have access to a computer facility capable of the following – this is essential for the course:

- Ready and continuous access to the Penn State University Canvas course website,
- Download and upload of PDF files from and to Canvas,
- Scanning homework solutions to create a PDF file (see below),
- Viewing and listening to videos, and

- Viewing dynamic PDF pencasts with embedded audio (if applicable).

Academic Integrity: This is an entirely online course, therefore, it is critical that all students read and understand all Penn State University academic integrity policies (see information below). Student work will be monitored and academic integrity policies will be vigorously enforced.

Each student is expected to practice active ethics. Group work is encouraged but individual original submission is required. Violators of academic integrity will receive a **ZERO** on the graded activity in question and will have a violation report placed in his/her permanent file. All students are encouraged to review the following Pennsylvania State University policies on academic integrity and it applies to all aspects of this course:

- *Academic Administrative Policies and Procedures Manual, G-9: Academic Integrity* http://www.psu.edu/oue/aappm/G-9-academic-integrity.html
- *Undergraduate Advising Handbook, Academic Integrity* http://handbook.psu.edu/content/academic-integrity
- University Faculty Senate Policy 49-20 *Academic Integrity* http://www.psu.edu/ufs/policies/separate_policy/49-20.htm

OFFICE FOR DISABILITY SERVICES

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: http://equity.psu.edu/ods/dcl. For further information, please visit the Office for Disability Services Web site: http://equity.psu.edu/ods.

Wk	Date	Topic	Reading	Video Lecture
	5/14	• Course Administration • Reinforced Concrete Materials • Introduction to Reinforced Concrete Structures	Chapters 1 and 3	0.0_VID_Course Administration 1.1_VID_Intr. & Fundamental
		• Codes and Specifications • Loads, Load Transfer, and Load Combinations • Design Philosophy	Chapter 2 Sections:2.1-2.4, 2.6, and 2.7-2.9	2.1_VID_Loads-and-Specs Examples 2.1 VID
		• Flexural Behavior • Flexural Theory ACI • Analysis of Singly reinforced Concrete (SRC) Beam	Chapter 4: Pages 105-110 Pages: 11-142	4.1_VID_Flexural Theory Examples 4.1 & 4.2 VID Examples 4.3 &4.4 VID 4.2_VID_Analysis-of-SRC-Beam
		• Analysis of Singly Reinforced Concrete (SRC) Beam	Chapter 4	Example 4.5 VID Example 4.6 VID
2	5/21	• Analysis of Doubly Reinforced Concrete (DRC) Beam	Chapter 4 Pages: 142-151	4.3_VID_Analysis-of-DRC-Beam Example 4.7 VID
		• Analysis of T Beam	Chapter 4 Pages: 152-164	4.4VID_Analysis-of-T-Beam Example 4.8 VID Example 4.9 VID
		• Analysis versus Design • Design of Rectangular SRC Beam	Chapter 5 Pages: 195-220	5.1_VID_Analysis-Vs-Design 5.2_VID_Design-SRC-Beams Example 5.1 VID
3	5/28	• Design of T Beam	Chapter 5 Pages: 195-220	5.3_VID_Design-of-T-Beam Example 5.2 VID
		• Design of T Beam	Chapter 5 Pages: 195-220	Example 5.3 VID
		• Design of DRC beam	Chapter 5 Pages: 220-228	5.4_VID_Design-of-DRC-Beam Example 5.4 VID
	June 6-8	**LOADS, ANALYSIS AND DESIGN OF SRC, DRC, AND T BEAMS**	**2 Hour Mid-Term Examination available Wednesday, June 6. Must be completed by 5:00pm, Friday, June 8. A scan of the original student solution must be received no later than close of business, June 12.**	
4	6/04	• Shear Behavior and Reinforcement • Analysis with and Without Stirrups • Shear Design of RCB	Chapter 6 Pages: 243-286	6.1VID_Shear Behavior of RCB 6.2_VID_Shear Design of RCB General Examples VID Example 6.1 VID
		Serviceability/Deflection	Chapter 9 Pages: 419-429 and 439-457	9.1_VID_Deflection Example 9.1 VID Example 9.2 VID
		• Bond and Development Length	Chapter 8 Pages: 359-384	8.1_VID_Development-Length Examples 8.1 & 8.2 VID
5	6/11	• Theoretical and actual Cut-off points	Chapter 8 Pages: 384-412	8.2VID_Cut-Off-Points Example 8.3 VID
		• Design of One-way Slab and Continuous beam	Chapter 10 Pages: 464-488	10.1_VID_Design-of-One-Way-Slab-and-Continuous-Beam Example 10.1 VID
		• Design of Axially Loaded Column	Chapter 11 Pages: 495-501	11.1_VID_Design-of-Axially-Loaded-Column Example 11.1VID Example 11.2 VID
6	6/18	• Design of Column Supporting Axial Load and Moment • Development of Interaction Diagram (ID) • Design of Column supporting axial load and moment	Chapter 11 Pages: 502-526 and 535-543	11.2_VID_Design-of-Column-For-Axial-and-Moment Example 11.3, I.D. VID Example 11.4 VID Example 11.5 VID Example 11.6 VID
	June 20-22	**FINAL EXAMINATION**	**2-Hour Final Examination available 8:00 am Wednesday, June 20. Must be completed by 5:00pm, Friday, June 22. A scan of the original student solution must be received no later than close of business, June 25.**	