CE 301 - STRUCTURAL ANALYSIS

SPRING 2012
TTH - Lowry 100
Section #1 9:30 – 10:45 A.M.

Professor: Dr. Sez Atamturktur *(Dr. Atam)*
sez@clemson.edu – Lowry 200
Office Hours: WF 8:00 – 10:00 A.M.

1. COURSE OBJECTIVES:

My philosophy when teaching an undergraduate course is to inspire curiosity and to convey the thought process in solving problems that form the essence of engineering.

Specific skills you will learn in this class will include:

- Determination of internal forces in elements of a statically determinate truss.
- Determination of deflections of a statically determinate truss.
- Determination of reactions, shear forces and bending moments on elements of a statically determinate beam and frame.
- Determination of slopes and deflections of a statically determinate beam and frame.
- Calculation of approximate shear forces and bending moments in sway frames.
- Determination of reactions, shear forces and bending moments on elements of a statically indeterminate beam and frame.
- Determination of the influence of moving loads on a beam and truss.

Students can expect to acquire these abilities only if they honor all course policies, attend class regularly, complete all assigned work on time and in good faith, and meet all other course requirements and expectations.

2. COURSE ADMINISTRATION:

Administration: This course will be managed on ***MyCLEmson***, and is accessible to enrolled students at https://bb.clemson.edu/. Please make use of this site, and consistently check it for updates.

Prerequisites: A pass grade in CE 206 or ME 304. Prerequisites will be strictly enforced.

Required Text: Structural Analysis, Fourth Ed., by Aslam Kassimali.

Books on Reserve at the Library:
TA645 .H47 Hibbeler, R. C., (1995), Structural Analysis.

Office Hours: Students are welcomed to make use of office hours. Office hours should not be considered as condensed versions of missed lectures or as means of verifying the homework solutions before the deadline.

3. PROFESSOR'S EXPECTATIONS:

Class Participation: Active participation is a very important part of your learning process. Active participation includes attendance, attention, preparation (reading lecture material in advance), asking questions, answering questions and participation in in-class problem-solving sessions. A student who is prepared and continually and actively processes the class material will master CE301.

You will learn material by completing assigned reading and problem sets, in addition to material presented in lectures. Examples worked in class are not sufficient for mastery of the material. You must work additional problems on your own – the professor will regularly provide additional problems during lectures. All major course announcements, including date changes, will be given in lecture sessions. Students are responsible for all information administered in lecture sessions. *Therefore, attendance to lecture sessions is mandatory.* However, if the instructor does not arrive within the first 15 minutes of the class, students may leave.

Homework: Homework will be assigned weekly on Tuesdays. Students will have one week to complete the homework. Homework will be collected only by the professor at the beginning of the Tuesday lecture class. No late assignments will be accepted. **Form** the habit of treating your homework assignments as *professional correspondence*. The discipline and professionalism you gain now will help you both in your job search and throughout your career.

Homework must be done neatly, in pencil, on 8 ½" x 11" engineering paper, stapled together. Each step must be easily followed; diagrams are useful. *All assumptions must be stated explicitly.* Homework that is not neat and legible may be rejected. Unclaimed work will be retained for 6 weeks after the start of the next semester and then discarded.

Working together on homework is encouraged. However, for your own sake, turn in homework that reflects your complete, *personal* understanding of the material. This standard is self-enforcing –your individual understanding will be reflected in the problems you work on the examinations.

Examinations: The exam problems will be designed to assess your fundamental understanding of the course objectives. This means that the examination problems will probably **NOT** resemble problems worked in class or in the homework. All quizzes, midterms and the final examination will be *comprehensive*. It is important that students are able to build and apply previous knowledge to each new task or challenge. The format of each midterm may vary. Unless otherwise specified, all examinations are closed book / notes.

If the student provides the professor with credible written evidence of a legitimate excuse, *there will be one (and only one) comprehensive make-up exam at the end of the semester.* Unannounced and ungraded quizzes may also be given throughout the semester to monitor comprehension.

4. ACADEMIC INTEGRITY:

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

When, in the opinion of a faculty member, there is evidence that a student has committed an act of academic dishonesty, the faculty member shall make a formal written charge of academic dishonesty, including a description of the misconduct, to the Associate Dean for Curriculum in the Office of Undergraduate Studies. At the same time, the faculty member may, but is not required to, inform each involved student privately of the nature of the alleged charge.

The Honor Code: Each student must comply with the Honor Code as approved by The College of Engineering of Clemson University.

5. COURSE GRADING:

Each student's *lowest Homework Score* will be dropped. An *optional*, *comprehensive fourth midterm* will be provided for those who (1) want to replace one of their first three midterm exams that has been attended by the student with the optional fourth and (2) have a legitimate written reason for a make-up. This course's grades may be curved or adjusted to shift students' grades positively, but not negatively.

Homework		11%
Three Midterm Exams		45%
First Midterm	12 %	
Second Midterm	14 %	
Third Midterm	19 %	
Final Examination		25%
Final Project		19%
Instructor's Bonus		±1%

Any objections to the homework, exam or project grades must be submitted in **written format** with justification supported by citations from textbooks, lectures or in-class discussions within one week after each exam.

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6. TENTATIVE COURSE SCHEDULE:

Lecture Schedule

Week	Lecture	Day	Date	Topic	Text	Notes / Assignments
1	1	TH	1/12/2012	Syllabus Overview	Kassimali Chapter 1	Classes Begin
2	2	T	1/17/2012	Loads on Structures	Kassimali Chapter 2	HW1 Assigned
	3	TH	1/19/2012	Loads on Structures		
3	4	T	1/24/2012	Equilibrium and Support Reactions	Kassimali Chapter 3	HW1 Due / HW 2 Assigned
	5	TH	1/26/2012	Equilibrium and Support Reactions		
4	6	T	1/31/2012	Plane Trusses	Kassimali Chapter 4	HW2 Due / HW 3 Assigned
	7	TH	2/2/2012	Plane Trusses		
5	8	T	2/7/2012	Beams: Shear and Moment Diagrams	Kassimali Chapter 5	HW3 Due / HW 4 Assigned
	9	TH	2/9/2012	Beams: Shear and Moment Diagrams		**EVENING EXAM #1**
6	10	T	2/14/2012	Frames: Shear and Moment Diagrams	Kassimali Chapter 5	HW4 Due / HW 5 Assigned
	11	TH	2/16/2012	Frames: Shear and Moment Diagrams		
7	12	T	2/21/2012	Deflection in Beams: Geometric Methods	Kassimali Chapter 6	HW5 Due / HW6 Assigned
	13	TH	2/23/2012	Deflection in Beams: Geometric Methods		
8	14	T	2/28/2012	Principle of Virtual Work	Kassimali Chapter 7	HW6 Due / HW7 Assigned
	15	TH	3/1/2012	Deflections Using Virtual Work: Trusses		
9	16	T	3/6/2012	Deflections Using Virtual Work: Beams	Kassimali Chapter 7	HW7 Due / HW8 Assigned
	17	TH	3/8/2012	Deflections Using Virtual Work: Frames		**EVENING EXAM #2**
10	18	T	3/13/2012	Introduction to Indeterminate Systems	Kassimali Chapters 11 & 12	HW8 Due/ HW9 Assigned
	19	TH	3/15/2012	Approximate Analysis of Frames		
11	20	T	3/20/2012	SPRING BREAK	Kassimali Chapter 13	HW9 Due / HW10 Assigned
	21	TH	3/22/2012	SPRING BREAK		
12	22	T	3/27/2012	Method of Consistent Deformations	Kassimali Chapter 13	HW10 Due on Monday/ HW11 Assigned
	23	TH	3/29/2012	Method of Consistent Deformations		
13	24	T	4/3/2012	Method of Consistent Deformations	Kassimali Chapters 13 & 17	HW10 Due / HW11 Assigned
	25	TH	4/5/2012	Moment Distribution		**EVENING EXAM #3**
14	26	T	4/10/2012	Moment Distribution	Kassimali Chapter 17	HW11 Due / HW12 Assigned
	27	TH	4/12/2012	Moment Distribution		
15	28	T	4/17/2012	Influence Lines	Kassimali Chapter 8	HW12 Due
	29	TH	4/19/2012	Influence Lines		**OPTIONAL EVENING EXAM**
16	30	T	4/24/2012	Project Presentations!!!		Project Reports Due!!!
	31	TH	4/26/2012	Project Presentations!!!		

The above schedule, policies and assignments in this course are subject to change in the event of extenuated circumstances.

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HINTS FOR SUCCESS IN CE 301:

- Do not get behind. Studying regularly and devoting the necessary time to review the class material is the key for success. Although the time required to master the material may vary depending both on the student and topic, I recommend studying 9 -12 hours a week.

- Working numerous problems is the best way to learn structural analyses and design. Show your best effort in all homework problems. However, your studies should not be limited to homework problems; you must solve additional problems on your own. Throughout the course, guidance will be given in identifying additional problems.

- There is no substitution for working together with friends. Teaching each other and asking questions are fundamental to learning. Make sure you have a study group for this class.

- Before and after a new topic is covered in class, read the material provided in the course packet. Reading in advance will help you to understand the lecture better, while the later reading will help you to refresh your memory and see the big picture.

- Start thinking about the Final Project immediately after reading the project description.

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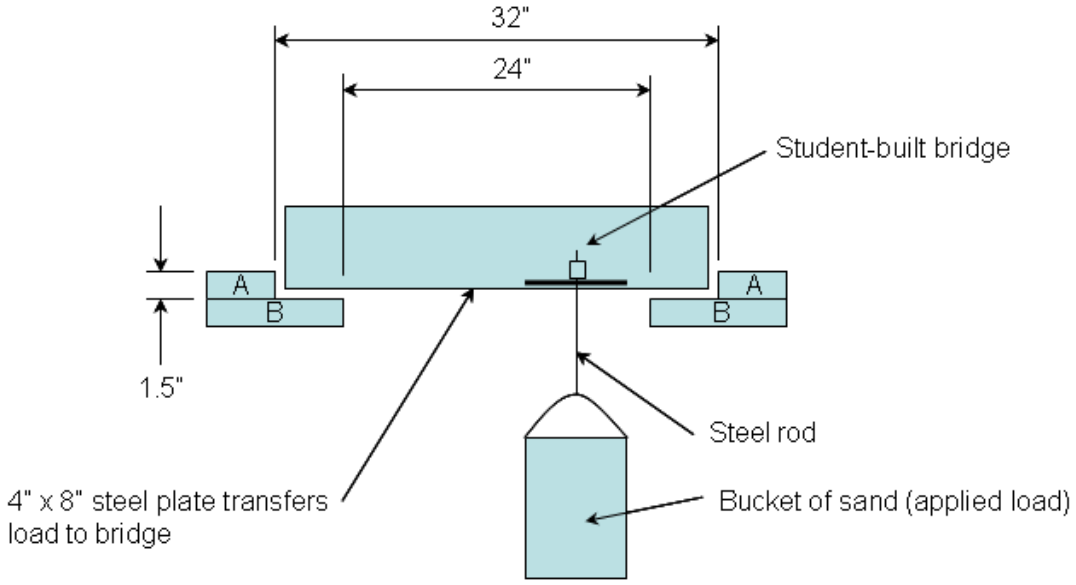
FINAL PROJECT DESCRIPTION

The task is to design and build a model bridge from balsa wood to span the 24" clear distance indicated above. The bridge will be loaded at its **1/3rd span** to collapse or 0.5" total deflection, whichever comes first. Recognition will be given to the designers of the **ductile bridge with the greatest strength to weight ratio** (i.e. avoid brittle failure while carrying the maximum load with minimal self-weight).

Students will report the (1) structural analysis, (2) design, (3) construction, (4) testing and (5) forensic analysis of the model bridge. The report should be 8-10 pages single-spaced text with graphs, pictures, figures, calculations, etc. The report should describe the structure type chosen and explain the load path through which the structure carries load to its supports. The report should also describe the process used to determine the member sizes and connection details. Hand calculations and/or computer analysis may also be attached as an appendix. The report should also include a forensic (failure) analysis, which discusses how/why the bridge collapsed and make recommendations for future improvements. At least one color photo of the bridge before and after testing is required. The title page of the report must have a **photo of all group members**.

Design groups will be teams of **5** students. Students will have the option to sign up in a team of their choice. Any student not signing up with a team will be assigned to one by the instructor by the ***second week*** of the semester. Within the first **six weeks** of the semester, the groups are required to prepare a tentative plan and meet the professor during office hours. Entire team must be present during the meeting. One homework assignment within the first **eight weeks** of the semester will be devoted to the Final Project to monitor progress of each group. For this homework assignment, each group will submit one homework problem.



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Design Criteria:

- The bridge should not weigh more than 12 ounces.
- All joints should be glued – the type of glue used is up to the design group.
- The top of support A represents the level of the approach roadway. The "roadway" of the bridge must match this elevation at each end. The bridge must have a solid deck to simulate the roadway, except for the ½" hole(s) noted below.
- The structure is supported by the top of support B only. It may not bear against the sides of A or B. The supports should be conceived to be a true "roller" connection.
- A minimum roadway width of 6" and a minimum vertical clearance of 6" are required.
- The maximum width and height of the structure at any point are 12" and 9", respectively.
- A ½" diameter hole must be provided in the bridge deck at 1/3rd - length and mid-width for application of the test load. Load will be applied via a single tension rod. A ½" hole must be provided at the center of the bridge that the rod can pass through in order to apply load on the steel plate.

Grading Rubric:

Criteria	**Marginal**	**Proficient**	**Exemplary**
Bridge S/W Ratio ***20%***	200 or less *15%*	Between 200 and 300 *18%*	300 or more *20%*
Report ***40%***	Assignment instructions not followed. Writing plagiarized from other sources. Incomplete, incorrect or incoherent technical information. *0%*	Assignment instructions followed. The report is original work. Complete, correct and coherent technical information is. *35%*	An evident effort beyond a 'proficient report.' The report includes reference material as well as proper citations. *40%*
Presentation ***30%***	An informal presentation and poor use of allocated time. *5%*	A formal, well organized, coherent presentation with correct information. *27%*	Analysis and synthesis of information beyond 'proficient' level. *30%*
Team- Work ***10%***	Delayed assignment submissions. Poor craftsmanship of the bridge. *5%*	An evidence of productive team work and proficiency in the craftsmanship of the bridge. *15%*	An evidence of productive and punctual team work and excellence in the craftsmanship of the bridge. *20%*

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