CE474 – STRUCTURAL ANALYSIS II [Spring 2010]	MWF 1:30-2:20pm, EE270 http://cobweb.ecn.purdue.edu/~ce474
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PREREQUISITES

- CE371
- Good understanding of laws of physics, statics, mechanics of materials, behavior of deformable bodies, calculus, and linear algebra including matrix methods.

DESCRIPTION

Basic concepts of structural analysis; approximate methods of analysis; virtual work principles; displacement based matrix structural analysis (linear, static): derivation of element stiffness matrices, assembly procedures; special topics in structural analysis. Emphasis will be on analysis of plane (2D) truss and frame structures.

COURSE OUTLINE

Review of Basic Concepts in Structural Analysis

- Equilibrium conditions
- Statical determinacy/indeterminacy
- Kinematic determinacy (degree of freedom)

Approximate Methods in Structural Analysis

- Approximate analysis of trusses
- Approximate analysis of moment-frame building systems for vertical loads
- Approximate analysis of moment-frame building systems: portal method and cantilever method

Work-Energy Methods in Structural Analysis

- Conservative systems
- Strain energy due to axial, bending, shear, torsional forces and deformation
- Using real work to find real deflections

Virtual Work Methods in Structural Analysis

- Principle of virtual forces; using virtual forces to find real deflections (dummy/unit load method)
- Deflections due to temperature changes, member misfits
- Betti's law & Maxwell's law of reciprocal deflections
- Principle of virtual displacements; using virtual displacements to find real forces
- Use of virtual displacements in plastic (limit state) analysis

Displacement Method (Stiffness Method) of Structural Analysis

- Quick review of matrix algebra
- Truss element; beam element; frame element
- Stiffness influence coefficients
- Local coordinates versus global coordinates; coordinate transformations
- Fixed end forces/moments
- Formation of the global analysis equations
- General assembly procedure
- Direct stiffness analysis of planar truss systems, frame systems

Special Issues in Stiffness Analysis of Structures (optional)

- Finite size joints (rigid zones at member ends); flexible joints
- Stiffness influence coefficients of shearwall elements

GRADING
Homeworks: 10% (all problems have equal weight unless otherwise noted)
Two term exams: 25% each
Final exam: 40%

Arithmetic average of three exams needs to be at least 60/100 to receive a passing grade.

Final grades will be based on standard catalogue grade division at the discretion of the instructor:
$A \geq 90 \mid 90 > B \geq 80 \mid 80 > C \geq 70 \mid 70 > D \geq 60 \mid 60 > F$

When it comes to grades, what counts is not what you could do or could have done but what you actually do. Please be aware of the consequences of failing in this course particularly if you think you are a graduating senior.

HOMEWORKS
Homeworks are due at the beginning of class on the date noted; no late homeworks will be accepted.

Homeworks will be distributed in class and posted on the course website. If you miss the hand-out, it is your responsibility to get it from the website. Homework solutions from previous years shall not to be consulted.

Homework solutions should be intelligible and of professional quality. Use engineering paper. Do not crowd solutions into a single page (i.e. start each solution on a separate page). Draw your illustrations neatly (use of a straight edge/ruler is encouraged) and indicate relevant parameters and coordinates on your illustrations (labels, degrees of freedom, coordinate system, etc.). State your assumptions where not obvious. Your final answer should be identifiable; no multiple answers. If it is not possible to follow your solution logic, you may get zero point for your solution even if your "final" answer has the right numbers.

You will get full point for a problem if you submit a relevant and intelligible solution. In case of blank, irrelevant or unintelligible solution you will get no point. You will receive feedback regarding the quality of your solution (letter grades *A*, *B*, *C*, *D*, *F*). *F* means zero point. It is up to you to study and understand the concepts and steps involved in each problem. Homework solutions will be posted on the course website after the due date.

ACADEMIC INTEGRITY & COURSE HONOR CODE
Purdue University academic policies and procedures apply. Simply put, never take unfair advantage of others.

COLLABORATION POLICY
Homeworks: It is strongly encouraged that you solve the homework problems on your own. In any case, your solution write-up should be, by definition, yours. Photocopy submissions will receive zero points.

Exams: No collaboration or sharing of any kind is allowed. Zero-tolerance against transgressions.

REFERENCE BOOKS
There is no textbook for this course. However, the book by Hibbeler (see below, underlined) is recommended.

- *Structural Analysis: A Unified Classical and Matrix Approach* – A. Ghali and A.M. Neville. 2nd ed., Chapman and Hill, 1978 (newer ed. exists)
- *Matrix Structural Analysis* – W. McGuire, R.H. Gallagher, R.D. Ziemian. 2nd ed., J. Wiley and Sons, 2000 (relatively advanced)
- *Structural Analysis*, R. C. Hibbeler, 6th or 7th ed., Pearson/Prentice Hall, 2006 or 2008.
- *Theory of Matrix Structural Analysis* – J.S. Przemieniecki. Dover, 1985 (1968 McGraw-Hill ed.)
- *Matrix Structural Analysis* – R.L. Sack. PWS-KENT Publishers, 1989
- *Matrix Structural Analysis* – M.D. Vanderbilt. QPI Press, 1974
- *Introductory Structural Analysis* – C.K. Wang and C.G. Salmon. Prentice-Hall, 1984.
- *Intermediate Structural Analysis* – C.K. Wang. International ed., McGraw-Hill, 1983 (other ed.)

CLASSROOM POLICY

If you are expecting an emergency phone call or text message, you need to let the instructor know at the beginning of a class. Otherwise, all cell phones, mobile devices including instant messaging/texting devices, and computers have to be turned off. No exceptions. Turning the sound off is not sufficient. Please be respectful towards your classmates and the instructor, and do not disturb the flow of the class.

If you are sure you should rather be doing something else (like chatting, texting, listening to music, following the latest news on Facebook, Twitter, etc., or sleeping), you are welcome not to come to the class. Note that if you are absent from a classroom meeting, you are responsible for catching up with the rest of the class.

Once the class starts you are expected to stay in the classroom until the end of the meeting except for emergency reasons (emergency phone call, restroom use, or simply, emergency).

ABSENCE DUE TO HEALTH PROBLEMS/CONCERNS

If you think you may have a cold, flu, or any other contagious disease, or simply not feeling well, please: 1) see your doctor or visit PUSH immediately; 2) do not come to class; you may safely consider yourself excused from attending class. You do not need to provide doctor's report for occasional classroom absence due to health concerns; an email to the instructor would suffice.

In the case of a health problem prohibiting you from attending class for more than two consecutive class meetings, please be prepared to present a report from your doctor explaining your situation. If you miss/will be missing an exam due to a health problem, you will have to present the doctor's report recommending that you should be exempt from taking an exam at scheduled time. A PUSH/doctor's appointment note stating that you have seen a doctor is not sufficient documentation to be exempt from an exam.

Students missing classroom meetings are responsible for catching up with the rest of the class.

EMERGENCY PREPAREDNESS

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Here are ways to get information about changes in this course.

1. The instructor or the TA will email you information through a one-way, broadcast type mailing-list: spring2010-ce-47400-001@lists.purdue.edu.
2. If you want to communicate your questions to the instructor directly, the best way to reach him is via email at ayhan@purdue.edu. A less efficient way to reach him is by phone at (765) 496-8270.
3. The course website at http://cobweb.ecn.purdue.edu/~ce474 will be updated with information.

In case of a campus emergency closure, virtual classroom meetings, for example via AdobeConnect, could be held. Should such an action become necessary, you will receive an email with information as to how you could participate in virtual meetings for this class. Until then, we will keep our classes as "real" as possible.

If for any pandemic or other emergency reasons one or more of the exams need to be cancelled the following weights will be used in calculating the final grade for performance in this course:

- One term exam cancelled: HW: 15%, one term exam: 35%; final exam: 50%
- Both term exams cancelled: HW: 30%; final exam: 70%
- Final exam cancelled: HW: 20%; term exams: 40% each

Final grades will be based on standard catalog procedure, at the discretion of the instructor.

For more information on Purdue campus emergency planning and preparedness, please visit http://www.purdue.edu/emergency_preparedness/index.htm.

Last but not least, please make yourself familiar with the evacuation routes in the EE building.