CVLE-212: Structural Analysis

Dr. Wael Zatar
Fall 2006

Credit: 4 credits
Course: Tuesday and Thursday 9.30-10.45 a.m., GH5
Computational Lab: Thursday 3.00-5.50 p.m., GH211

Course Description:

Analysis of forces and deflections in determinate and indeterminate structures; influence lines for beams and trusses; dead, live, snow, and wind loads on structures; and introduction to computer programs for structural analysis.

Textbook:

Fundamentals of Structural Analysis, West, Harry H. & Geschwindner, L.F., John Wiley, 2nd Edition, 2002.

References:

Minimum Design Loads for Buildings and Other Structures, SEI/ASCE 7-02

Course Prerequisites:

Mechanics of Materials, equivalent, or consent of instructor

Course Co-requisite:

Math - Multivariable Calculus, equivalent, or consent of instructor

Office Hours:

Wednesday 1.00 p.m. ~ 4.00 p.m.

For those of you who will not be able to meet the instructor during the assigned office hours, the instructor has an open door policy, which means that you are welcome to come and ask him by appointment or at an appropriate time.

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Objective:

To acquaint the student with the classical methods of solving determinate and indeterminate structures. Upon completion of the course, the student should be able

to analyze determinate and indeterminate beams, frames, and trusses. Students will be introduced to computer modeling and computer analysis of beams, frames, and trusses.

Outcomes:

With the successful completion of the course, the student should:

1) Be able to determine the reactions of determinate structures.
2) Be able to solve for the internal member forces in determinate trusses.
3) Be able to draw shear and moment diagrams for beams and frames.
4) Be able to develop computer models of beams, frames, and trusses.
5) Be able to determine beam deflections using the conjugate beam method.
6) Be able to determine beam, frame, and truss deflections using the virtual work method.
7) Be able to draw influence lines for beams and trusses.
8) Be able to determine structural loads on structures due to dead , live, and snow loads using ASCE 7.
9) Be able to solve indeterminate beams, frames, and trusses using the force method through virtual work.
10) Be able to solve indeterminate beams and frames using the slope-deflection method.
11) Be able to solve indeterminate beams and frames using the moment distribution method.

Assessment:

All learning outcomes will be assessed through questions in class and the evaluations of homework and examination problems.

Topics:

Topic*	**Reading**
Determinate Structural Analysis	
Analysis of Determinate Structures	3.1 – 3.5
Reactions - Cantilever Structures	3.1 – 3.5
Reactions – Three Hinge Arches	3.1 – 3.5
Trusses - Method of Joints	4.1 - 4.9
Trusses - Zero Members	4.1 - 4.9
Trusses - Method of Sections	4.1 - 4.9
Shear and Moment Diagrams-Beams	5.1 - 5.11
Shear and Moment Diagrams-Frames	5.1 - 5.11
Beam Deflections - Conjugate Beam	8.6
Maximum Beam Deflection - Conjugate Beam	8.6
Test No. 1	
Beam Deflections - Virtual Work	8.7
Frame Deflections - Virtual Work	8.7
Truss Deflections - Virtual Work	7.1 - 7.5
Influence Lines - Beams	6.1 - 6.5
Computer Analysis - Beams and Frames	SAP 2000

Computer Analysis - Trusses	SAP 2000
Influence Lines - Beams	6.1 - 6.5
Influence Lines - Trusses	6.1 -6.5
Moving Loads - Maximum Shear & Moment	6.6
Test No. 2	

Indeterminate Structural Analysis

Method of Consistent Deformations - Force Method	9.1 - 9.9; 10.1 - 10.8
Virtual Work-Beams	9.1 - 9.9; 10.1 - 10.8
Virtual Work-Frames	9.1 - 9.9; 10.1 - 10.8
Virtual Work-Trusses	9.1 - 9.9; 10.1 - 10.8
Slope-Deflection Method - Beams	11.1 - 11.4
Slope-Deflection Method - Frames, No Sidesway	11.5
Slope-Deflection Method - Frames, With Sidesway	11.5
Moment Distribution - Beams	12.1 - 12.7
Test No. 3	
Moment Distribution - Beams	12.1 - 12.7
Moment Distribution - Beams	12.1 - 12.7
Moment Distribution - Frames, No Sidesway	12.8 - 12.9
Moment Distribution - Frames, With Sidesway	12.8 - 12.9
Dead Loads	1.8; ASCE 7-02
Dead Loads	1.8; ASCE 7-02
Floor Live Loads	1.8; ASCE 7-02
Roof Live Loads	1.8, ASCE 7-02
Snow Loads	1.8, ASCE 7-02
Final Exam	

** The instructor reserves the right to slightly change the topics and their order to achieve the maximum benefit of the course learning outcomes.*

Contribution to Program Outcomes:

1. an ability to apply knowledge of mathematics, science, and engineering

2c. an ability to analyze and interpret data

3. an ability to design civil engineering projects or components of projects to meet desired needs

5. an ability to identify, formulate, and solve civil engineering problems

9a. a recognition of the need to engage in life-long learning

9b. an ability to engage in life-long learning

11. an ability to use techniques, skills, and modern engineering tools necessary for engineering practice

Contribution to Professional Component of the Program Curriculum:

The entire course is devoted to basic structural engineering principles (see topic description) and problems that are similar to those frequently encountered in professional practice. The course is where the student is first introduced to

computer analyses and determination of loads ona structure using the ASCE7 design standards.

Accreditation Category Content:

Engineering Science:	4 credits	(100%)
Engineering Design :	0 credits	(0%)

Computer Usage:

SAP 2000 Software**

Electronic mail for effective communication between the professor and students

**: Analysis of beams and other simple structural systems will be discussed. The students are required to provide interpretations of the software results and to compare the results with known or hand calculations. The students are also encouraged to check their homework hand solutions using the computer software

Homework:

- Homework will be regularly assigned either during the class/lab time or by e-mail.
- Checking your e-mail is required on a daily-basis for information regarding homework assignment.
- Homework must be submitted before the starting time of class on the assignment date.
- Late homework is not acceptable except for unusual circumstances, e.g., an excused absence.
- You are expected to provide your homework in engineering papers - not a Xerox copy.
- Homework must be neat, readable, and must conform to acceptable Standards of Engineering Computation.

Exams:

Three exams and a final exam will be given during the course of the semester. Exams will be closed book and closed notes. No makeup exams will be given with the exception of unusual circumstances (institutional excuse, severe injuries, family emergencies, etc.).

Grading Policy:

Homework	25%
Exam 1	15%
Exam 2	15%
Exam 3	15%
Final Exam	30%

Letter Grade Scale:

90-100	A
80- 89	B
70-79	C
60-69	D
0-59	F

The instructor does reserve the right to slightly curve or scale the grades based on class groupings.

Engineering Ethics and Academic Honesty:

It will be assumed that each student subscribes to a professional code of ethics that is the basis for his/her behavior in class. Any and every case where the professional code of ethics and academic honesty are violated will be dealt with in accordance with the student handbook and the governing provisions of Marshall University.

Additional Information:

[1] You may ask the instructor during the office hours for any question or clarification. This should, in no way, inhibit your asking questions at the end of the class.

[2] You are expected to attend all classes and labs. However, the instructor accepts your absence for one session provided that an advance notice will be given, unless this is unavoidable. Non-excused absence for few lecture/lab sessions will result in a lower overall grade of the course. Frequent absence from either the classes or labs may result in a failing grade.

[3] The instructor will not discuss the grades in e-mails or phone calls.