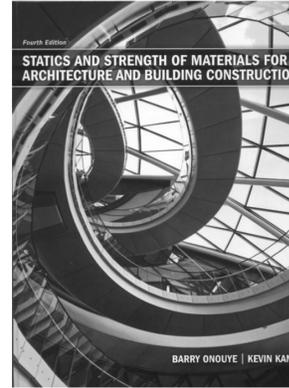# ARCHITECTURE 324

# STRUCTURES II

## Course Introduction:

Course Syllabus
Course Format
Online Resources

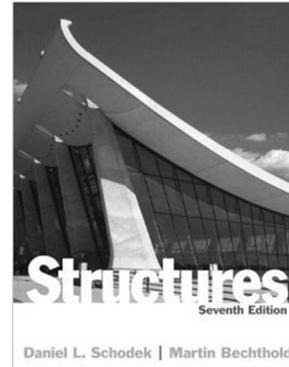## Teaching Staff:

Prof.
Dr.-Ing. Peter von Bülow     pvbuelow@umich.edu

GSI's:
  002     Abdallah Kamhawi     kamhawi@umich.edu
  003     Abdallah Kamhawi     kamhawi@umich.edu
  004     Amely Wackerbauer    awackerb@umich.edu
  005     Hui Zhu                      huizz@umich.edu
  006     Mohsen Vatandoost   mohsenv@umich.edu
  007     Mohsen Vatandoost   mohsenv@umich.edu

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# Course Syllabus

## Organization

- Lecture – Monday & Wednesday
- Recitation – Friday
- HW Problems – on web
- Topic Quiz - weekly

## Evaluation

- 24 Lecture Quizzes     240
- 13 Topic Quizzes     260
- 12 HW Problems     820
- Tower Project     250
- 10 Recitation Labs     200

## Text

- *Structures* by Schodek
- *Statics and Strength of Materials* by Onouye
- Code material on Canvas
- Web site
  structures.tcaup.umich.edu

Architecture 324                                              structures.tcaup.umich.edu/
3 credit hours                                                                      Winter 2026
**ARCHITECTURAL STRUCTURES II**
Syllabus

**Prof. Peter von Buelow**     Section 001  9:30-10:30 MW
pvbuelow@umich.edu          **Recitation Sections       F**        **GSI's**
Office 1205c TCAUP            Section 002   9:30-10:30       Abdallah Kamhawi     kamhawi@umich.edu
Phone 763-4931                  Section 003  10:30-11:30      Abdallah Kamhawi     kamhawi @umich.edu
                                        Section 004   9:30-10:30       Amely Wackerbauer   awackerb@umich.edu
office hours:                      Section 005  10:30-11:30      Hui Zhu                      huizz@umich.edu
by appointment               Section 006  10:30-11:30      Mohsen Vatandoost   mohsenv@umich.edu
                                        Section 007   9:30-10:30       Mohsen Vatandoost   mohsenv@umich.edu

**CATALOG DESCRIPTION**

This course covers the basic principles of elastic behavior for different materials such as wood, steel, concrete and composite materials, and compares the properties and applications of materials generally. It investigates cross sectional stress and strain behavior in flexure and in shear, and torsion as well as the stability of beams and columns. The qualitative behavior of combined stresses and fracture in materials is also covered. Prerequisite: ARCH 314

**OBJECTIVES**

Students are introduced to the fundamentals of analysis and design of simple structural members in wood, steel, concrete and masonry. Basic code requirements of strength, stability and serviceability are discussed. Both vertical and lateral loads based on ASCE-7 are considered. Principles of composite materials design, and structural continuity are covered.

**ORGANIZATION**

The course is comprised of lectures (Monday & Wednesday) and a recitation (Friday). The lectures will be posted on the course website and may be watched asynchronously if you cannot attend in person. Lecture attendance is not required, however there is a quiz with each lecture. The lectures cover structural concepts and procedures of design using the primary building materials of wood, steel, concrete and masonry. Each Friday the class is broken into smaller recitation sections in which the GSIs review analysis procedures of the various structural elements discussed in the lectures. Recitations may also include an in-class lab assignment. Solutions to homework problems are entered online through the course website. Topics are summarized weekly through Canvas Topic Quizzes. In addition, a construction/testing project gives students an opportunity to apply concepts to a physical design. Computer facilities, including software, are available on machines in the building, for supporting computations.

**EVALUATION**

Evaluation is based on an accumulated total number of points. Points are earned based on performance in all course activities – 24 lecture quizzes, 12 Canvas topic quizzes, 11 homework problems, 9 recitation labs, and the tower project. Grades are assigned according to the number of points achieved during the semester:

                          24 lecture quizzes 10 pts each                      240
                          13 topic quizzes 20 pts each                        260
                          12 homework problems, 5pts/ question  820
                          tower testing project                                      250
                          10 recitation labs, 20 pts each                      200
                                                              TOTAL     1770

The point scale relates to a full range of letter grades assigned as follows:

| A+ | 1711 | A | 1652 | A- | 1593 |
|---|---|---|---|---|---|
| B+ | 1534 | B | 1475 | B- | 1416 |
| C+ | 1357 | C | 1298 | C- | 1239 |
| D+ | 1180 | D | 1121 | D- | 1062 |
| | | E | 1061 and below | | |

By University policy the minimum passing grade is a D (1121). For graduate students C- (1239) is required to pass. The highest recorded grade in Architecture is an A.

# Course Schedule

## Lectures

Monday & Wednesday

video recorded and posted on Canvas

## Recitation

Friday with GSI

online signup – see emailed link

## Homework

On course website "Problems"

## Quizzes

Lecture Quizzes – in class or in Canvas video

Canvas (weekly Topic Quiz)

## Project

tower

weight and load

| DATE | TOPIC | Text Reading | PROBLEMS (due dates online) |
|---|---|---|---|
| JAN 7 | Course Intro | Onouye, Schodek | |
| JAN 9 | 1 - Wood Properties | NDS | |
| JAN 12 | 2 - Wood Beam Analysis | Schodek 6.4.2 | |
| JAN 14 | 3 - Wood Beam Design | Onouye 8 | |
| JAN 16 | Recitation [1-Wood Beams] | | |
| | | Topic Quiz 1 | 1. Wood Beam Analysis |
| JAN 19 | Martin Luther King Day **** No Class **** Martin Luther King Day **** No Class | | |
| JAN 21 | 4 - Wood Column Analysis | Onouye 9.1-9.2 & 9.4, Schodek 7.4.3 | |
| JAN 23 | Recitation | | |
| | | Topic Quiz 2 | 2. Wood Beam Design |
| JAN 26 | 5 - Wood Column Design | NDS   Tower Intro | |
| JAN 28 | 6 - Cross Laminated Timbers | CLT Handbook | |
| JAN 30 | Recitation [2-Wood Columns] | | |
| | | Topic Quiz 3 | 3. Wood Column Analysis |
| FEB 2 | 7 - Steel Properties | AISC, Onouye 8.7 | |
| FEB 4 | 8 - Steel Beam Analysis | Schodek 6.4.3 | |
| FEB 6 | Recitation – Tower Project | | |
| | | Topic Quiz 4 | 4 Steel Beam Analysis |
| FEB 9 | 9 - Steel Beam Design | Schodek 6.4.3 | |
| FEB 11 | 10 - Steel Column Analysis | Onouye 9.3, Schodek 7.4.4 | |
| FEB 13 | Recitation [3-Steel Beams] | Prelim. Tower Report Due | |
| | | Topic Quiz 5 | 5. Steel Beam Design |
| FEB 16 | 11 - Steel Column Design | Onouye 9.3, Schodek 7.4.4 | |
| FEB 18 | 12 - Continuous Beams | I. Engel Ch. 17, Schodek 8 | |
| FEB 20 | Recitation [4-Steel Columns] | | |
| | | Topic Quiz 6 | 6. Steel Column Analysis |
| FEB 23 | 13 – 3-Moment Theorem | | |
| FEB 25 | "Tower without Ends" Tony Fitzpatrick video | | |
| FEB 27 | Recitation [5-Continuous Beams] | | |
| | | Topic Quiz 7 | |
| MAR 2 | WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS **** | | |
| MAR 4 | WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS **** | | |
| MAR 6 | WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS **** | | |
| MAR 9 | 14 - Gerber Beams | Schodek 8.4.4 | |
| MAR 11 | 15 - Intro to Concrete – PCA video | | |
| MAR 13 | Recitation [6-Flexural Strain] | | |
| | | Topic Quiz 8 | 7. Three Moment Theorem |
| MAR 16 | 16 - Concrete Beam Analysis | Schodek 6.4.4 – 6.4.6 | |
| MAR 18 | 17 - Concrete Beam Design | I. Engel Ch.15 | |
| MAR 20 | Recitation [7-Concrete Reinforcing] | | |
| | | Topic Quiz 9 | 8. Concrete Beam Analysis |
| MAR 23 | Tower Testing **** Tower Testing **** Tower Testing **** Tower Testing **** | | |
| MAR 25 | 18 - T-Beams | Schodek 7.4.5 | |
| MAR 27 | Recitation | | |
| | | Topic Quiz 10 | 9. Concrete Beam Design |
| MAR 30 | 19 - Concrete Columns | | |
| APR 1 | 20 - Pre-Stressing | | |
| APR 3 | Recitation [8 – Pre-Stressing] | | |
| | | Topic Quiz 11 | 10. Pre-Stress |
| APR 6 | 21 - Composite Sections | | |
| APR 8 | | | |
| APR 10 | Recitation [9-Composite Sections] | | |
| | | Topic Quiz 12 | 11. Composite Sections |
| APR 13 | 22 - Masonry Intro. | TMS 402 | |
| APR 15 | 23 - Masonry Walls | TMS 402 | |
| APR 17 | Recitation [10-Lateral Stability] | Final Tower Report Due Sunday | |
| | | Topic Quiz 13 | 12. Masonry Walls (due Tues.) |
| APR 20 | 24 - Masonry Vaults & Shells | | |

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# Course Web Site      structures.tcaup.umich.edu



Structures

MICHIGAN Architecture

Contact

| Contact | Schedule | Lectures | Recitation | Towers1 | Towers2 | Problems |

Structures II Website - ARCH 324

**Professor Peter von Buelow, Dr.-Ing.**

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USA

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| Amely Wackerbauer | awackerb@umich.edu |
| Hui Zhu | huizz@umich.edu |

Recitation Sections

## Lectures

## Recitation

# Recitation Sign Up

**https://forms.gle/8Fxv2L257JGXrDhS9**

## Arch 324 Recitation Sign Up

This form is to allow you the option to try to choose a certain section for your recitation. If you have a course conflict with certain times, be sure to list it

A section will be filled by the first 20 students to choose that section. Or if you have a time conflict that requires a certain section (like 10:30 - 11:30) the last one in will get bumped out. So if you have a time conflict you must enter the section(s) you can attend even if they are full.

Here is the list of Sections with GSIs:

| | | | | |
|---|---|---|---|---|
| 002 | Abdallah Kamhawi | Friday | 9:30-10:30 | rm ARR |
| 003 | Abdallah Kamhawi | Friday | 10:30-11:30 | rm ARR |
| 004 | Amely Wackerbauer | Friday | 9:30-10:30 | rm ARR |
| 005 | Hui Zhu | Friday | 10:30-11:30 | rm ARR |
| 006 | Mohsen Vatandoost | Friday | 10:30-11:30 | rm 2104 |
| 007 | Mohsen Vatandoost | Friday | 9:30-10:30 | rm 2104 |

**pvbuelow@umich.edu** Switch account

* Indicates required question

Email *

☐ Record **pvbuelow@umich.edu** as the email to be included with my response

Section 1st choice *

Choose ▾

Section 2nd choice

Choose ▾

Section 3rd choice

Choose ▾

I have a time conflict at this time and cannot attend a recitation at this time

☐ 9:30-10:30

☐ 10:30-11:30

A copy of your responses will be emailed to pvbuelow@umich.edu.

Submit          Clear form

# Tower Test

## Tower Test

## Computer Problems

Uniqname

UM ID Number

## Computer Problems

### Problem Menu

Check Grades

Problem FAQ

Select Problem

Download Instructions

Work Problem (best of 3 versions)



MICHIGAN Architecture — Structures / Problems

Contact | Schedule | Lectures | Recitation | Project | **Problems**

Logged in as: PvB

Problems
[Check Points]
Problem FAQ

| # | Description | Due Date | Current Scores |
|---|---|---|---|
| - 1 - | Wood Beam Analysis | 1-31-2021 | (1) 15/85 not completed (2) 0/85 not completed (3) 0/85 not completed |
| - 2 - | Wood Beam Design | 2-07-2021 | (1) 0/100 not completed (2) 0/100 not completed (3) 0/100 not completed |
| - 3 - | Wood Column Analysis | 2-14-2021 | (1) 0/75 not completed (2) 0/75 not completed (3) 0/75 not completed |
| - 4 - | Steel Beam Analysis | 2-21-2021 | (1) 0/85 not completed (2) 0/85 not completed (3) 0/85 not completed |
| - 5 - | Steel Column Analysis | 2-28-2021 | (1) 0/45 not completed (2) 0/45 not completed (3) 0/45 not completed |
| - 6 - | Three Moment Theorem | 3-07-2021 | (1) 0/60 not completed (2) 0/60 not completed (3) 0/60 not completed |
| - 7 - | Composite Sections | 3-21-2021 | (1) 0/55 not completed (2) 0/55 not completed (3) 0/55 not completed |

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## Computer Problems

### Problem Page

Choose Data Set

Enter Answers

Submit

Read Score

Correct if Necessary



MICHIGAN Architecture — Structures / Problems

Contact | Schedule | Lectures | Recitation | Project | **Problems**

Logged in as: PvB

**1. Wood Beam Analysis**

Analyze the given 4x dimensioned lumber beam to determine if it passes or fails the NDS code criteria. The beam carries both dead and live floor load plus its own selfweight. Check the actual shear and bending stresses against the factored allowable stresses including all applicable factors from the NDS. Load duration is based on the live load (CD = 1.0). Assume normal temperature, and no incising (Ct = Ci = 1.0). Find the beam selfweight including the given moisture content. The beam is braced at the ends and the C.L. (meets criteria in 4.4.1) so CL = 1.0.

DATASET: 1 [-2-] [-3-]

| | |
|---|---|
| Wood Species | HEM-FIR |
| Wood Grade | Select Structural |
| Span A | 16 FT |
| Span B | 12 FT |
| Nominal Depth of Beam, d | 12 IN |
| Moisture Content, m.c. | 15 % |
| Floor DL | 7 PSF |
| Floor LL | 35 PSF |

| # | Question | Your Response | Correct Answer | Score |
|---|---|---|---|---|
| 1 | Tabulated Allow. Bending Stress, Fb | 1400 PSI | 1400 PSI | 5 |
| 2 | Tabulated Allow. Shear Stress, Fv | 150 PSI | 150 PSI | 5 |
| 3 | Tabulated Wood Dry Density (specific gravity) | 0.43 | 0.43 | 5 |
| 4 | Total Actual Applied Point Load, P | LBS | SUBMIT | |
| 5 | Wood Density (Including M.C.) | PCF | SUBMIT | |
| 6 | Beam Selfweight (Including M.C.), w | PLF | SUBMIT | |
| 7 | Actual Beam Bending Moment, M | FT-LB | SUBMIT | |
| 8 | Actual Maximum Shear Force (at reaction) , V | LBS | SUBMIT | |
| 9 | Size Factor, CF | | SUBMIT | |
| 10 | Wet Service Factor for Fb, CM_b | | SUBMIT | |
| 11 | Wet Service Factor for Fv, CM_v | | SUBMIT | |
| 12 | Factored Allow. Bending Stress, F'b | PSI | SUBMIT | |
| 13 | Factored Allow. Shear Stress, F'v | PSI | SUBMIT | |
| 14 | Actual Bending Stress, fb_actual | PSI | SUBMIT | |
| 15 | Actual Shear Stress, fv_actual | PSI | SUBMIT | |
| 16 | Bending Stress Passing: enter "1" for pass or "0" for fail | (1 or 0) | SUBMIT | |
| 17 | Shear Stress Passing: enter "1" for pass or "0" for fail | (1 or 0) | SUBMIT | |

# Tips on how engineering students study for exams