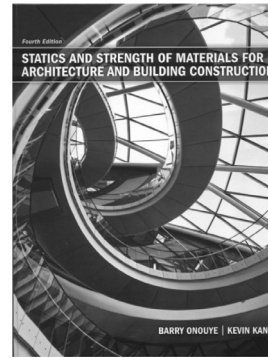


ARCHITECTURE 324

STRUCTURES II

Course Introduction:

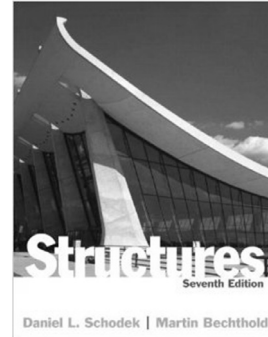
Course Syllabus
 Course Format
 Online Resources



Teaching Staff:

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

GSI's:
 002 Mohsen Vatandoost mohsensv@umich.edu
 003 Mohsen Vatandoost mohsensv@umich.edu
 004 Yifan Ma yifanma@umich.edu
 005 Aditya Jaiswal jaaditya@umich.edu
 006 Dylan Ling tyling@umich.edu



Course Syllabus

Organization

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

Evaluation

- 25 Lecture Quizzes 250 ✓
- 13 Topic Quizzes 260 ✓
- 12 HW Problems 860 ✓
- Tower Project 250 ✓
- 10 Recitation Labs 200

Text

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

Architecture 324
 3 credit hours

<http://www.structures.tcaup.umich.edu/>
 Winter 2024

ARCHITECTURAL STRUCTURES II Syllabus

Prof. Peter von Bülow pvbuelow@umich.edu Office 1205c TCAUP Phone 763-4931	Section 001 9:30-10:30 MW	GSI's Mohsen Vatandoost mohsensv@umich.edu Mohsen Vatandoost mohsensv@umich.edu Yifan Ma yifanma@umich.edu Aditya Jaiswal jaaditya@umich.edu Dylan Ling tyling@umich.edu
	Recitation Sections F Section 002 8:30-9:30 Section 003 9:30-10:30 Section 004 9:30-10:30 Section 005 9:30-10:30 Section 006 11:30-12:30	
office hours: by appointment		

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, structural continuity, and combined stresses 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. 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 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 – 25 lecture quizzes, 13 Canvas topic quizzes, 12 homework problems, 10 recitation labs, and the tower project. Grades are assigned according to the number of points achieved during the semester:

25 lecture quizzes 10 pts each	250
13 topic quizzes 20 pts each	260
12 homework problems, 5pts/ question	600
tower testing project	250
10 recitation labs, 20 pts each	200
TOTAL	1820

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

A+ 1759	A 1699	A- 1638
B+ 1577	B 1517	B- 1456
C+ 1395	C 1335	C- 1274
D+ 1213	D 1153	D- 1092
	E 1091 and below	

By University policy the minimum passing grade is a D (1153). The highest recorded grade in Architecture is an A. For graduate students C- (1274) is required to pass.

Course Schedule

Lectures

Monday & Wednesday
video recorded and posted

Recitation

Friday with GSI

Homework

course website

Quizzes

Canvas (weekly)

Project

tower
weight and load

DATE	TOPIC	Text Reading	PROBLEMS (due dates online)
JAN 10 JAN 12	Course Intro Wood Properties	Onouye, Schodek NDS	
JAN 15	Martin Luther King Day **** No Class **** Martin Luther King Day **** No Class		
JAN 17 JAN 19	Wood Beam Analysis Recitation [1-Wood Beams]	Schodek 6.4.2	1. Wood Beam Analysis
JAN 22 JAN 24 JAN 26	Wood Beam Design Column Buckling Recitation	Onouye 8 Onouye 9.1-9.2 & 9.4, Schodek 7.4.3	2. Wood Beam Design
JAN 29 JAN 31 FEB 2	Wood Columns - Tower Intro Cross Laminated Timbers Recitation [2-Wood Columns]	NDS CLT Handbook	3. Wood Column Analysis
FEB 5 FEB 7 FEB 9	Steel Properties Steel Beam Analysis Recitation [3-Steel Beams]	AISC, Onouye 8.7 Schodek 6.4.3	4. Steel Beam Analysis
FEB 12 FEB 14 FEB 16	Steel Beam Design Steel Column Analysis Recitation [4-Steel Columns]	Schodek 6.4.3 Onouye 9.3, Schodek 7.4.4	Prelim. Tower Report Due 5. Steel Beam Design
FEB 19 FEB 21 FEB 32	Steel Column Design "Skyscrapers" David Macaulay video Recitation	Onouye 9.3, Schodek 7.4.4	6. Steel Column Analysis
FEB 26 FEB 27 MAR 1	WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS ****		
MAR 4 MAR 6 MAR 8	Continuous Beams Gerber Beams Recitation [5-Continuous Beams]	I. Engel Ch. 17, Schodek 8 Schodek 8.4.4	7. Three Moment Theorem
MAR 11 MAR 13 MAR 15	Intro to Concrete - PCA video. Concrete Beams Recitation	Schodek 6.4.4 - 6.4.6	
MAR 18 MAR 20 MAR 22	Tower Testing **** Tower Testing **** Tower Testing **** Tower Testing **** Concrete Beams Recitation [6-Stress vs Strain]	I. Engel Ch.15	8. Concrete Beam Analysis
MAR 25 MAR 27 MAR 29	Concrete Beams Concrete Columns Recitation [7-Concrete Reinforcing]	Schodek 7.4.5	9. Concrete Beam Design
APR 1 APR 3 APR 5	Composite Sections Masonry Walls Recitation [8-Composite Sections]	TMS 402 TMS 402	10. Composite Sections
APR 8 APR 10 APR 12	Masonry Walls Shells and Vaults Recitation [9-Lateral Stability]	TMS 402 Schodek 12	Final Tower Report Due 11. Masonry Walls
APR 15 APR 17 APR 19	Combined Stress Combined Stress Recitation [10-Combined Stress]	I. Engel Ch. 19 I. Engel Ch. 19	12. Combined Stress
APR 22	Prestress & Post Tension		

Course Web Site

<http://www.structures.tcaup.umich.edu/>

Structures

Contact

Contact
Schedule
Lectures
Recitation
Towers1
Towers2
Problems

Structures II Website - ARCH 324

Professor Peter von Buelow, Dr.-Ing.

Taubman College of Architecture and Urban Planning
University of Michigan
2000 Bonisteel Blvd.
Ann Arbor, MI 48109
USA

tel. +1 734 763 4931

pvbuelow@umich.edu

Office hours:
by appointment

GSI's:

Mohsen Vatandoost
Yifan Ma
Aditya Jaiswal
Dylan Ling

mohsensv@umich.edu
yifanma@umich.edu
jaaditya@umich.edu
tyling@umich.edu

Recitation Sections

Where is your GSI?

Lectures

M MICHIGAN Architecture Structures Lectures

Contact Schedule Lectures Recitation Towers1 Towers2 Problems

2022 Lectures Canvas

Video / w Quiz

Date	Lectures	Video	Slides	Notes
Jan 10	Course Intro	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Jan 12	Wood Properties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Recitation

M MICHIGAN Architecture Structures Recitation

Contact Schedule Lectures Recitation Towers1 Towers2 Problems

GSIs2024 width=

More Example Problems Recitation Sections

Recitation Topics	Labs	Mohsen Vatandoost 002 Notes	Mohsen Vatandoost 003 Video	Yifan Ma 004 Notes	Aditya Jaiswal 005 Notes	Dylan Ling 006 Notes	old1 Video	old2 Old
Wood Beam Analysis 1/19	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wood Beam Design 1/26	none	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wood Columns 2/2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steel Beam Analysis 2/9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Tower Test

M MICHIGAN Architecture

Structures Project

Contact Schedule Lectures Recitation Project Problems

Test Video 2018 Photos from Testing Report Guidelines 2018 Example Report Optimization Paper

Tips on DrFrame DrFrame Example

Score Formula: $[(4 \times \text{weight in OZ}) + (\text{load in LBS}/50) + (\text{load}/\text{weight})/12.5] \times 25$

Choose a team to view.

Sort by Views Descending

Team Name	Score	Load	Weight	LoadRatio	Views
~IT mIdET hOId ttrY P0uHdS~	177	325	4	5.3	69
TBA	174	325	3.9	5.2	34
The Perks of Being a Tall Tower	128	245	4	3.6	28
JackJob and the Beamstak	121	225	3.9	3.6	22
Tower 101	118	225	4	3.5	28
Tower tower	110	210	4	3.3	23

Computer Problems

Uniqname

UM ID Number

M MICHIGAN Architecture

Structures Problems

Contact Schedule Lectures Recitation Project Problems

You must supply a uniqname.

Please login to access this page:

uniqname:

ID#

Login

or login with

uniqname = guest

and

UMID# = 123

Computer Problems

Problem Menu

Check Grades

Problem FAQ

Select Problem

Download Instructions

Work Problem (3 versions)

#	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

Computer Problems

Problem Page

Choose Data Set

Enter Answers

Submit

Read Score

Correct if Necessary

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 ($Cl = Cl = 1.0$). 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 Selection:

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

Diagram: A 4x4 wood beam of length $SPAN\ B$ and height $SPAN\ A$. The beam is supported at both ends. A point load P is applied at the center of the span. The load diagram shows a rectangular load of width w and height P over the span $SPAN\ B$. The beam is braced at the ends and the center line (C.L.).

#	Question	Your Response	Correct Answer	Score
1	Tabulated Allow. Bending Stress, F_b	1400 PSI	1400 PSI	5
2	Tabulated Allow. Shear Stress, F_v	150 PSI	150 PSI	5
3	Tabulated Wood Dry Density (specific gravity)	0.43	0.43	5
4	Total Actual Applied Point Load, P			
5	Wood Density (including M.C.), w			
6	Beam Selfweight (including M.C.), w			
7	Actual Beam Bending Moment, M			
8	Actual Maximum Shear Force (at reaction), V			
9	Size Factor, CF			
10	Wet Service Factor for F_b , CM_b			
11	Wet Service Factor for F_v , CM_v			
12	Factored Allow. Bending Stress, F_b			
13	Factored Allow. Shear Stress, F_v			
14	Actual Bending Stress, f_b , actual			
15	Actual Shear Stress, f_v , actual			
16	Bending Stress Passing: enter "1" for pass or "0" for fail	(1 or 0)		
17	Shear Stress Passing: enter "1" for pass or "0" for fail	(1 or 0)		

Tips on how engineering students study for exams

