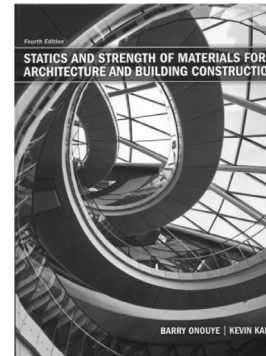


ARCHITECTURE 324

STRUCTURES II

Course Introduction:

Course Syllabus
 Course Format
 Online Resources

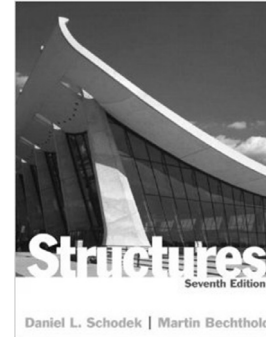


Teaching Staff:

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

GSIs:

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006	Kamon Nartnarumit	kamon@umich.edu



Course Syllabus

Organization

- Lecture – Monday & Friday (asynchronous)
- Recitation – Wednesday (synchronous)
- HW Problems – on web
- Topic Quiz - weekly

Evaluation

- 13 Topic Quizzes 260
- 12 HW Problems 855
- Tower Project 250
- 9 Recitation Labs 180

Text

- *Structures* by Schodek
- *Statics and Strength of Materials* by Onouye
- Code material on Canvas
- Web site
<https://www.umich.edu/~arch324>

Architecture 324
 3 credit hours

<http://www.structures.tcaup.umich.edu/>
 Winter 2022

ARCHITECTURAL STRUCTURES II Syllabus

Prof. Peter von Buelow pvbuelow@umich.edu Office 1205c TCAUP Phone 763-4931 office hours: by appointment	Section 001 9:30-10:30 MF	Recitation Sections with GSI's
	Section 002 9:30-10:30	Elyssa Bakker elyssab@umich.edu
	Section 003 10:30-11:30	Jessica Duschean duschean@umich.edu
	Section 004 9:30-10:30	David Lee ddle@umich.edu
	Section 005 10:30-11:30	Yuyan Wang yuyanw@umich.edu
	Section 006 9:30-10:30	Kamon Nartnarumit kamon@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, structural continuity, and combined stresses are covered.

ORGANIZATION

The course is comprised of lectures (Monday & Friday) and a recitation (Wednesday). The lectures will be posted on the course website and may be watched asynchronously if you cannot attend in person. 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 Wednesday 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 in the BT Lab, room 1221, for supporting computations.

EVALUATION

Evaluation is based on an accumulated total number of points. Points are earned based on performance in all course activities – 13 Canvas topic quizzes, 12 homework problems, 9 recitation labs, and the tower project. Grades are assigned according to the number of points achieved during the semester:

13 topic quizzes 20pts each	260
12 homework problems, 5pts/ question	855
tower testing project	250
9 recitation labs, 20pts each	180
TOTAL	1545

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

A+	1494	A	1442	A-	1391
B+	1339	B	1288	B-	1236
C+	1185	C	1133	C-	1082
D+	1030	D	979	D-	927
		E	926 and below		

By University policy the minimum passing grade is a D (979). The highest recorded grade in Architecture is an A. For graduate students C- (1082) is required to pass.

Course Schedule

Lectures

Monday & Friday
video recorded and posted

Recitation

Wednesday with GSI

Homework

course website

Quizzes

Canvas (weekly)

Project

tower
weight and load

DATE	TOPIC	Text Reading	PROBLEMS (due dates online)
JAN 5	Course Intro	Onouye, Schodek	
JAN 7	Wood Properties	NDS	
JAN 10	Wood Beams	Schodek 6.4.2	
JAN 12	Recitation [1-Wood Beams]		
JAN 14	Wood Beams	Onouye 9.1 - 9.2	1. Wood Beam Analysis
JAN 17	Martin Luther King Day **** No Class ****	Martin Luther King Day **** No Class	
JAN 19	Recitation		
JAN 21	Column Buckling	Onouye 9.4, Schodek 7.4.3	2. Wood Beam Design
JAN 24	Wood Columns	NDS	
JAN 26	Recitation [2-Wood Columns]		
JAN 28	Cross Laminated Timbers	CLT Handbook	3. Wood Column Analysis
JAN 31	Tower Intro - Steel Properties	AISC Onouye 8.7	
FEB 2	Recitation [3-Steel Beams]		
FEB 4	Steel Beams	Schodek 6.4.3	4. Steel Beam Analysis
FEB 7	Steel Beams	Schodek 6.4.3	
FEB 9	Recitation	Prelim. Tower Report Due	
FEB 11	Steel Columns	Onouye 9.3 Schodek 7.4.4	5. Steel Beam Design
FEB 14	Steel Columns	Onouye 9.3 Schodek 7.4.4	
FEB 16	Recitation [4-Steel Columns]		
FEB 18	Continuous Beams	I. Engel Ch. 17, Schodek 8	6. Steel Column Analysis
FEB 21	Gerber Beams	Schodek 8.4.4	
FEB 23	Recitation [5-Continuous Beams]		
FEB 25	"Skyscrapers" David Macaulay video		7. Three Moment Theorem
FEB 28	WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS ****		
MAR 2	WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS ****		
MAR 4	WINTER RECESS **** NO CLASS **** WINTER RECESS **** NO CLASS ****		
MAR 7	Intro to Concrete - PCA video		
MAR 9	Recitation		
MAR 11	Concrete Beams	Schodek 6.4.4 - 6.4.6	
MAR 14	Tower Testing **** Tower Testing **** Tower Testing **** Tower Testing ****		
MAR 16	Recitation [6-Stress vs Strain]		
MAR 18	Concrete Beams	I. Engel Ch.15	8. Concrete Beam Analysis
MAR 21	Concrete Columns	Schodek 7.4.5	
MAR 23	Recitation [7-Concrete Reinforcing]		
MAR 25	Composite Sections		9. Concrete Beam Design
MAR 28	Masonry Walls	TMS 402	
MAR 30	Recitation		
APR 1	Masonry Walls	TMS 402	10. Composite Sections
APR 4	Masonry Walls	TMS 402	
APR 6	Recitation [8-Lateral Stability]	Final Tower Report Due	
APR 8	Shells and Vaults	Schodek 12	11. Masonry Walls
APR 11	Combined Stress	I. Engel Ch. 19	
APR 13	Recitation [9-Combined Stress]		
APR 15	Prestress & Post Tension	I. Engel Ch. 19	12. Combined Stress
APR 18	no class		

Course Web Site

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

MICHIGAN Architecture
Structures

[Contact](#)

Contact
Schedule
Lectures
Recitation
Towers1
Towers2
Problems

Structures II Website - ARCH 324

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Recitation Sections

Lectures

Week	Lectures	Due Date	Video	Slides	Notes
Week 1	Course Intro				
Week 1	Wood Properties	Jan 24			
Week 1	Wood Beam Analysis	Jan 24			

Recitation

Recitation Topics	Labs	Notes	Notes	Notes	Notes	Notes	Notes	Notes
Wood Beam Analysis 1/27								
Wood Beam Design 2/03	none							

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

Project 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: pvbuelow

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 $Cl = 1.0$.

Diagram: A 4x4 wood beam of length $SPAN\ B$ and depth d . A point load P is applied at the center. The beam is braced at the ends. The diagram also shows a cross-section labeled 'Section 4'.

Load Diagram: A horizontal beam of length $Span\ B$ with a point load P applied at the center. The beam width is w .

Dataset 1:

Parameter	Value
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

Answers Table:

#	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	<input type="text"/>	<input type="text"/>	
5	Wood Density (including M.C.), w	<input type="text"/>	<input type="text"/>	
6	Beam Selfweight (including M.C.), w	<input type="text"/>	<input type="text"/>	
7	Actual Beam Bending Moment, M	<input type="text"/>	<input type="text"/>	
8	Actual Maximum Shear Force (at reaction), V	<input type="text"/>	<input type="text"/>	
9	Size Factor, C_F	<input type="text"/>	<input type="text"/>	
10	Wet Service Factor for F_b , C_M	<input type="text"/>	<input type="text"/>	
11	Wet Service Factor for F_v , C_M	<input type="text"/>	<input type="text"/>	
12	Factored Allow. Bending Stress, F_b	<input type="text"/>	<input type="text"/>	
13	Factored Allow. Shear Stress, F_v	<input type="text"/>	<input type="text"/>	
14	Actual Bending Stress, f_b , actual	<input type="text"/>	<input type="text"/>	
15	Actual Shear Stress, f_v , actual	<input type="text"/>	<input type="text"/>	
16	Bending Stress Passing: enter "1" for pass or "0" for fail	<input type="text"/>	<input type="text"/>	
17	Shear Stress Passing: enter "1" for pass or "0" for fail	<input type="text"/>	<input type="text"/>	

Tips on how engineering students study for exams

