

ARCHITECTURE 324

STRUCTURES II

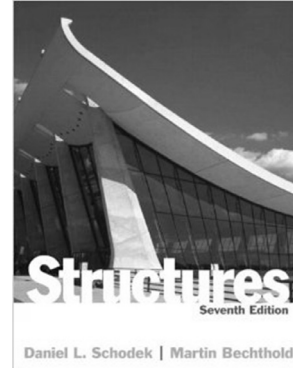
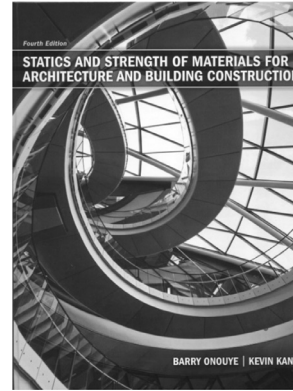
Course Introduction:

- Course Syllabus
- Course Format
- Online Resources

Teaching Staff:

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

- GSI's:
- | | | |
|-----|-------------------|--------------------|
| 002 | Elyssa Bakker | elyssab@umich.edu |
| 003 | Jessica Duscbean | duscbean@umich.edu |
| 004 | David Lee | ddle@umich.edu |
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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 Duscbean	duscbean@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.

ARCHITECTURAL STRUCTURES II (3)
Lecture and Assignment Schedule

Course Schedule

Lectures

Monday & Friday
video recorded and posted

WOOD

Recitation

Wednesday with GSI

STEEL

Homework

course website

Quizzes

Canvas (weekly)

CONCRETE

Project

tower
weight and load

MASONRY

DATE	TOPIC	Text Reading	PROBLEMS (due dates online)
X 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	Cerber 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/>

Structures

Contact

Contact
Schedule
Lectures
Recitation
Towers1
Towers2
Problems

Structures II Website - ARCH 324

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Recitation Sections

Lectures

M MICHIGAN Architecture Structures Lectures

Contact Schedule Lectures Recitation Project Problems

~~2021~~ 2020 Lectures Canvas

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

M MICHIGAN Architecture Structures Recitation

Contact Schedule Lectures Recitation Towers1 Towers2 Problems

more example problems Recitation Sections

Recitation Topics	Labs	Notes	Notes	Notes	Notes	Notes	Notes	Notes
Wood Beam Analysis 1/27		Elyssa Bakker 002	Jessica Duschean 003	David Lee 004	Yuyan Wang 005	Kamon Nartnarumit 006	old1	old2
Wood Beam Design 2/03	none							

Tower Test

The screenshot shows the 'Structures Project' page on the Michigan Architecture website. It features a navigation bar with 'Project' selected. Below the navigation is a large image of a tower under construction. A list of resources includes 'Test Video 2018', 'Photos from Testing', 'Report Guidelines 2018', 'Example Report', 'Optimization Paper', 'Tips on DrFrame', and 'DrFrame Example'. A score formula is provided: $Score Formula: [(4/weight \text{ in OZ}) + (load \text{ in LBS}/50) + (load/weight)/12.5] \times 25$. A 'Sort by' dropdown is set to 'Views' and 'Descending'. A grid of six project thumbnails is displayed, each with a title, score, load, weight, load ratio, and view count.

Project Title	Score	Load	Weight	LoadRatio	Views
-IT mUsT hOId fFty PoUnDs-	177	338.5	4	5.3	69
TBA	174	325	3.9	5.2	34
The Perks of Being a TallTower	128	245	4	3.8	28
Jac(k)ob and the Beansstalk	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

The screenshot shows the 'Structures Problems' page on the Michigan Architecture website. It features a navigation bar with 'Problems' selected. The main content area contains a login form with the following text: 'You must supply a uniqname.', 'Please login to access this page:', 'uniqname: pvbuelow', 'UM ID#: NUMBER', and a 'Login' button. Below the login form, it says 'or login with', 'uniqname = guest', 'and', 'UMID# = 123'.

Computer Problems

Problem Menu

Check Grades

Problem FAQ

Select Problem

Download Instructions

Work Problem (3 versions)

M 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

Computer Problems

Problem Page

Choose Data Set

Enter Answers

Submit

Read Score

Correct if Necessary

NDS

M 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 (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.

Diagram: 4x4 Wood Beam, SPAN B, SPAN A, Section 4, Load Diagram, w, P, Span B, 12'

Dataset:

Wood Species	HEM-FIR
Wood Grade	Select Structural SS
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, 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.)			
6	Beam Selfweight (Including M.C.), w			
7	Actual Beam Bending Moment, M			
8	Actual Maximum Shear Force (at reaction), V			
9	Size Factor, C _F			
10	Wet Service Factor for F _b , C _{M,b}			
11	Wet Service Factor for F _v , C _{M,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			
17	Shear Stress Passing: enter "1" for pass or "0" for fail			

Tips on how engineering students study for exams

