

# ARCHITECTURE 314

## Structures I

### Course Introduction:

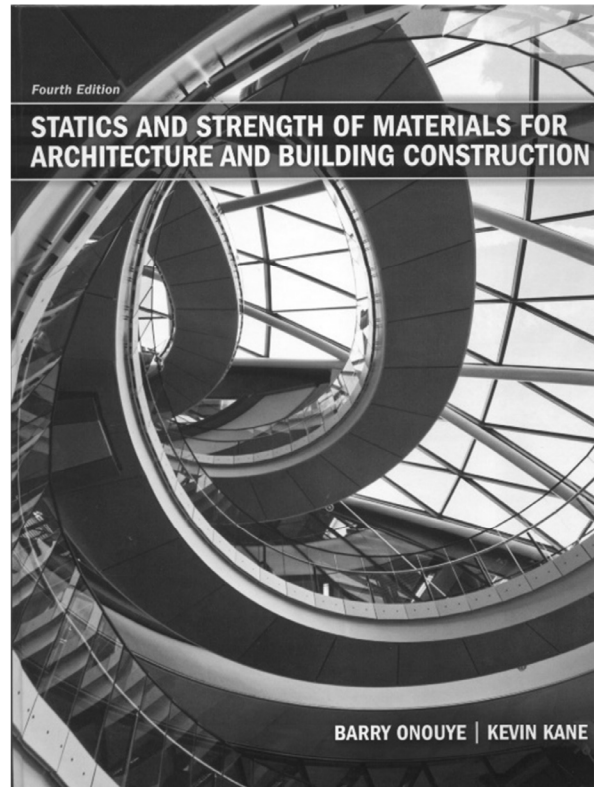
- Course Syllabus
- Course Schedule
- Online Resources
- Introduction to Structures

### Teaching Staff:

Prof.  
Dr.-Ing. Peter von Bülow [pvbuelow@umich.edu](mailto:pvbuelow@umich.edu)

GSI's:

Mitch Hodiono	<a href="mailto:mhodiono@umich.edu">mhodiono@umich.edu</a>	002
Qilmeg Doudatcz	<a href="mailto:qilemg@umich.edu">qilemg@umich.edu</a>	003
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## Course Organization

Lectures – posted on website  
2 per week

- Recitation – Wednesday
- 16 HW Problems – on website
- 12 Topic Canvas Quizzes (ca. each week)

### • Evaluation –

12 quizzes 20 pts	240
16 HW Problems	875
Bridge Project	250
10 Recitation Labs	200
<b>TOTAL</b>	<b>1565</b>

### • Text – (required)

*Statics and Strength of Materials for Architecture and Building Construction* (any edition)  
by B. Onouye & K. Kane

### • Example Problems – on website

### • Web Site

<http://www.structures1.tcaup.umich.edu>

Architecture 314  
3 credit hours

<http://www.umich.edu/~arch314>  
Fall 2022

### ARCHITECTURAL STRUCTURES I Syllabus

Dr.-Ing. Peter von Buelow <a href="mailto:pvbuelow@umich.edu">pvbuelow@umich.edu</a> Office 1205c TCAUP Phone (734) 763-4931 office hours – by appointment	Lectures MF 001 10:30-11:30 + posted online Recitation W: 002 9:30-10:30 Mitch Hodiono 003 10:30-11:30 Qi Lemuge 004 9:30-10:30 Tam Nguyen 005 10:30-11:30 Merhdad Shahraeen 006 10:30-11:30 Bangyu Xu	<a href="mailto:mhodiono@umich.edu">mhodiono@umich.edu</a> <a href="mailto:qilemg@umich.edu">qilemg@umich.edu</a> <a href="mailto:tamtrong@umich.edu">tamtrong@umich.edu</a> <a href="mailto:mehrdad@umich.edu">mehrdad@umich.edu</a> <a href="mailto:bangyuxu@umich.edu">bangyuxu@umich.edu</a>
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#### Catalog Description

This course covers the basic principles of architectural structures, including the influence of geometric, sectional, and material properties related to flexure and shear in beam and framed systems; vector mechanics with application to analysis of trusses, catenaries, and arches; diagrammatic analysis of beams for bending moment, shear, and deflection as well as the study of structural framing systems for vertical and lateral loads.

#### Objectives

Students are introduced to the fundamentals of statics and mechanics, as well as the behavior of structural materials and simple elements and systems subjected to gravity and lateral loads. Diagramming of force distribution in beams as well as topics of stress, strain and stability are covered. Through classroom demonstrations as well as physical construction and testing, aspects of strength and stability of structural systems are examined.

#### Organization

The course is lecture based, and the concepts and procedures are taught in this context with additional homework problems solved by the students. Weekly recitations provide opportunity for small demonstration labs as well as student-instructor interaction in smaller groups. A group design and construction project (load testing of a bridge) offers a chance to test out concepts covered in the class. Computer facilities, including software, are available for supporting computations. A course web site is used to post all lectures, homework problems, as well as other information for the class (<http://www.structures1.tcaup.umich.edu/>). Weekly topic quizzes will also be posted on the course Canvas site.

#### Evaluation

Evaluation is based on an accumulated total number of points. Points are earned based on performance in all course activities – topic quizzes (Canvas), homework problems, recitation labs, quizzes in lectures and the bridge project. Grades are based on the total number of points achieved during the semester:

12 topic quizzes, 20pts each	240
16 homework problems, 5 pts / question	875
bridge testing project	250
10 recitation labs, 20 pts each	200
<b>TOTAL</b>	<b>1565</b>

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

A	1461	A-	1409
B+	1356	B	1304
C+	1199	C	1147
D+	1043	D	991
		D-	939
		E	938 and below

By University policy the minimum passing grade for undergraduates is a D (991) and for graduate students it is a C (1147).

# Course Schedule

## ARCHITECTURAL STRUCTURES I (3) Lecture and Homework Schedule

DATES	TOPICS	Reading (Onouye 4 <sup>th</sup> ed.)	HW PROBLEMS
AUG 29	Course Intro. Overview of Forces	Ch. 1: pp. 1-14	Structures video TA 645.S78
AUG 31	Loading and Forces	Ch. 2.1: pp. 15-22	
SEP 2	Force Systems: Vector Addition Topic Quiz 1	Ch. 2.2 & 2.3: pp. 23-41	
SEP 5	<b>LABOR DAY ***** NO CLASS *****</b>	<b>LABOR DAY ***** NO CLASS *****</b>	<b>LABOR DAY ***** NO CLASS *****</b>
SEP 7	Recitation 1. Adding Forces		1. Dead Load Calculation (9.4)
SEP 9	Force Systems: Moment of a Force Topic Quiz 2	Ch.2.3: pp.42-80 Ch.3.6: pp.175-184	2. Vector Components (9.8)
SEP 12	Force Systems: Equilibrium	Ch. 2.4 – 2.6: pp. 61-95	3. Three Vector Addition (9.11)
SEP 14	Recitation 2. Moment of a Force		4. Moment of a Force (9.15)
SEP 16	Equilibrium of Rigid Bodies Topic Quiz 3	Ch. 3.2: pp. 111-118	5. Parallel Force Systems (9.20)
SEP 19	Cable Systems	Ch. 3.1: pp. 96-110	
SEP 21	Recitation 3. Equilibrium		
SEP 23	Catenary/ Arches and Shells + Bridge Project Introduction Topic Quiz 4		6. Equilibrium of Rigid Bodies (9.25)
SEP 26	Plane Trusses (by Joints)	Ch. 3.3: pp. 119-127	
SEP 28	Recitation 4. Truss Stability		
SEP 30	Plane Trusses (by Sections) Topic Quiz 5	Ch. 3.3: pp. 128-152	7. Cable Systems (10.3)
OCT 3	Plane Trusses (by Graphic Statics)		
OCT 5	Recitation 5. Graphic Statics	(Interim bridge report due - 10.6)	
OCT 7	Pinned Frames Topic Quiz 6	Ch. 3.4: pp. 163-163	8. Truss Systems (10.9)
OCT 10	Three Hinged Arches	Ch. 3.5: pp. 164-174	
OCT 12	Recitation 6. Three Hinged Arches		
OCT 14	Load Tracing & Floor Systems Topic Quiz 7	Ch. 4.1: pp. 195-230	9. Three Hinged Arches (10.16)
OCT 17	<b>***** FALL STUDY BREAK ***** FALL STUDY BREAK ***** FALL STUDY BREAK ***** FALL STUDY BREAK *****</b>		
OCT 19	Recitation Lateral Stability	Ch. 4.2: pp. 231-250	
OCT 21	Topic Quiz 8		10. Floor Systems (10.23)
OCT 24	Stress and Strain	Ch. 5.1: pp. 261-266	
OCT 26	Recitation		
OCT 28	Elasticity and Deformation Topic Quiz 9	Ch. 5.2-5.4: pp. 267-293	
OCT 31	Cross-Sectional Properties	Ch. 6.1 - 6.4: pp. 300-331	
NOV 2	Recitation 7. Elasticity		
NOV 4	<b>***** Bridge Testing ***** Bridge Testing ***** Bridge Testing ***** Bridge Testing *****</b>		11. Elastic Deformation (11.6)
NOV 7	Shear and Bending Forces	Ch. 7.1-7.3: pp. 332-345	
NOV 9	Recitation 8. Moment of Inertia		
NOV 11	Shear and Bending Forces Topic Quiz 10	Ch. 7.4-7.5: pp. 346-364	12. Centroid of Area (11.13)
NOV 14	Bending Stresses	Ch. 8.1-8.2: pp. 365-381	
NOV 16	Recitation		
NOV 18	Shear Stresses Topic Quiz 11	Ch. 8.1-8.2: pp. 365-381	13. Moment of Inertia (11.20)
NOV 21	video "When Engineering Fails"		
NOV 23	<b>***** THANKSGIVING RECESS ***** THANKSGIVING RECESS ***** THANKSGIVING RECESS *****</b>		
NOV 25	<b>***** THANKSGIVING RECESS ***** THANKSGIVING RECESS ***** THANKSGIVING RECESS *****</b>		
NOV 28	Deflection of Beams	Ch. 8.3-8.4: pp. 382-401	14. V & M Diagrams (11.28)
NOV 30	Recitation 9. Shear Stress	(final bridge report due - 12.2)	
DEC 2	Deflection of Beams Topic Quiz 12	Ch. 8.5: pp. 402-418	15. Horizontal Shear (12.4)
DEC 5	Combined Stress	Ch. 8.5: pp. 402-418	
DEC 7	Recitation 10. Deflection		
DEC 9	Combined Stress		16. Deflection of Beams (12.11)

### Lectures

Monday & Friday – on website

### Recitation

Wednesday – 10 Labs

### Exercise Problems

on course website

### Homework

on course website

### Course Website

<http://www.umich.edu/~arch314>

## Recitation – Sections

Use this link or from class email:

<https://forms.gle/2u2MyM5bKWVDkmMAA>

Choose a recitation section. The first 20 entries will fill the section. Then you get your second choice, etc.

Fill this out as soon as possible – Friday at latest.

### Arch 314 Recitation Signup

This form is to allow you the option to try to choose a certain section for your recitation or friends you would rather be with. If you don't care which section you get, you can skip that part and fill in the friends boxes - or vice versa. If you do both I will consider the section choice first.

Please choose section numbers or your friends' full names.

A section will be filled by the first 20 students to choose that section.

Here is the list of Sections with GSIs:

Section	GSI	Class Times	Room
ARCH 314-002	Mitch Hodiono	W 9:30AM - 10:30AM	East Review
ARCH 314-003	Qimeg Doudatcz	W 10:30AM - 11:30AM	East Review
ARCH 314-004	Tam Nguyen	W 9:30AM - 10:30AM	West Review
ARCH 314-005	Merhdad Shahraeen	W 10:30AM - 11:30AM	West Review
ARCH 314-006	Bangyu Xu	W 10:30AM - 11:30AM	Rm 2104

This form is automatically collecting emails for University of Michigan users. Change settings

Section 1st choice

1. 002

Section 2nd choice

1. 002

friend 1

Short answer text

time conflict with

1. 9:30 - 10:30

2. 10:30 - 11:30

M
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Structures

Contact

Contact
Schedule
Lectures
Recitation
Bridges1
Bridges2
Bridges3
Problems

Structures I - Arch 314 - Fall 2022  
 10:30 - 11:30 MF - Rm 2104

Professor Peter von Buelow, Dr.-Ing.

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Bangyu Xu	<a href="mailto:bangyuxu@umich.edu">bangyuxu@umich.edu</a>



Who is your GSI 


Where is your GSI 

## Lectures

M
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Architecture
Structures

Lectures

Contact
Schedule
Lectures
Recitation
Bridges1
Bridges2
Bridges3
Problems



2021 Lectures 

Topic Quizzes 

Lectures	Date	Video	Slides	Notes
Course Intro	Aug 29			
Loads on Structures	Aug 31			
Statics and Force Vectors	Sep 2			

# Recitation Notes & Labs

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Bridges3
Problems



**Notes & Videos from 2020:** 

**Section Rosters:** 

	Mitch H.	Qilmeg D.	Tam N.	Mehrdad S.	Bangyu X.
	002	003	004	005	006
<b>Recitation Topics:</b>	<b>Labs</b>	<b>Notes</b>	<b>Notes</b>	<b>Notes</b>	<b>Notes</b>
	Loads				
	Adding Forces				
	Moments of Forces				
	Equilibrium				

# Bridge Project

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Bridges 1
Bridges2
Bridges3
Problems



- Bridge Project Brief 2022 
- Prelim Report Guidelines 2022 
- Scoring Rubric 2022 
- Examples of Bridge Types 
- Example Reports  
- Dr. Frame Software (download) 
- Dr. Frame Tutorial  
- West Point Bridge Designer 
- Videos of Bridge Testing 

# Computer Problems

<http://www.structures1.tcaup.umich.edu/problems/problems.php>

Uniqname

UMID >>Number<< (NOT Kerberos)

**M MICHIGAN Architecture** Structures Problems

Contact Schedule Lectures Recitation Bridges1 Bridges2 Problems

You must supply a unique name.

Please login to access this page:

uniqname:

UMID#:

Login

or login with  
uniqname = guest  
and UMID# = 123

# Computer Problems

## Problem Menu

Check Grades

Select Problem

Download Instructions

**M MICHIGAN Architecture** Structures Problems

Contact Schedule Lectures Recitation Bridges1 Bridges2 Bridges3 Problems

Logged in as: Peter von Buelow

Problems  
Check Points  
Problem FAQ

#	Description	Due Date	Current Scores
- 1 -	Dead Load Calculation	9-04-2022	(1) 0/20 not completed (2) 0/20 not completed (3) 0/20 not completed
- 2 -	Vector Components	9-08-2022	(1) 0/15 not completed (2) 0/15 not completed (3) 0/15 not completed
- 3 -	Three Vector Addition	9-11-2022	(1) 0/50 not completed (2) 0/50 not completed (3) 0/50 not completed
- 4 -	Moment of a Force	9-15-2022	(1) 0/30 not completed (2) 0/30 not completed (3) 0/30 not completed
- 5 -	Parallel Force Systems	9-20-2022	(1) 0/25 not completed (2) 0/25 not completed (3) 0/25 not completed

# Computer Problems

M

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Architecture

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ContactScheduleLecturesRecitationBridges1Bridges2Problems

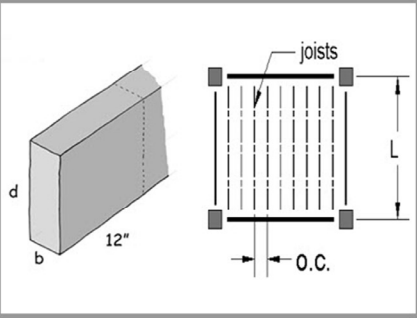
Logged in as: Peter von Buelow

### 1. Dead Load Calculation

For the given member cross section and length, find the DL in PLF of the joist member, total pounds of the member and PSF DL of the joist on the floor.

**DATASET 3**   -1-   -2-

Width, b	1.5 IN
Depth, d	7.25 IN
Length, L	6 FT
On center spacing	16 IN
Species class	Western Cedars
Density	25 PCF



#	Question	Your Response	Correct Answer	Score
1	The cross-sectional area: A	<input type="text"/> IN^2	<input type="button" value="SUBMIT"/>	
2	Dead load of joist section	<input type="text"/> PLF	<input type="button" value="SUBMIT"/>	
3	Dead load of whole joist member	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>	
4	Dead load of joists on floor	<input type="text"/> PSF	<input type="button" value="SUBMIT"/>	

Current Score:    0 / 20

# Structures

