

# ARCHITECTURE 314

## Structures I

### Course Introduction:

Course Syllabus

Course Schedule

Online Resources

Introduction to Structures

### Teaching Staff:

Prof.

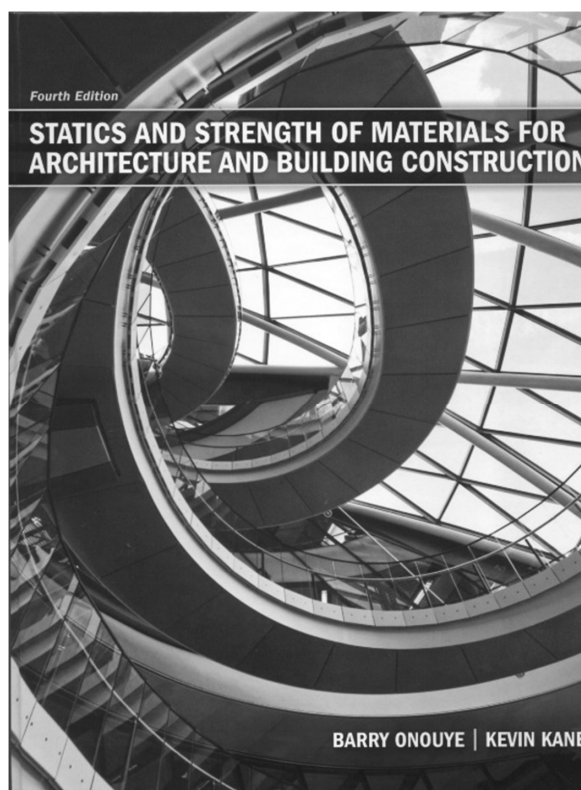
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## Course Organization

- Lectures – 2 per week - MW
- Recitation – Friday
- 24 Lecture Quizzes
- 14 Topic Canvas Quizzes
- 14 HW Problems – on website

### Evaluation –

|                    |             |
|--------------------|-------------|
| 24 lecture quizzes | 240         |
| 14 topic quizzes   | 280         |
| 14 HW Problems     | 800         |
| Bridge Project     | 250         |
| 12 Recitation Labs | 240         |
| <b>TOTAL</b>       | <b>1820</b> |

### Text – (required)

*Statics and Strength of Materials for Architecture and Building Construction* (any edition)

by B. Onouye & K. Kane

### Example Problems – on website

### Website

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

Architecture 314  
3 credit hours

<http://www.structures1.tcaup.umich.edu/>  
Fall 2025

### ARCHITECTURAL STRUCTURES I Syllabus

Dr.-Ing. Peter von Bülow  
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Office 1205c TCAUP  
Phone 763-4931

office hours:  
by appointment

#### 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 beams and framed systems; vector mechanics with application to analysis of trusses, catenaries, and arches; diagrammatic analysis of beams for bending moment, shear, and deflection; and 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. 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 – lecture quizzes, topic quizzes (Canvas), homework problems, recitation labs, and the bridge project. Grades are based on the total number of points achieved during the semester:

|                                        |             |
|----------------------------------------|-------------|
| 25 lecture quizzes, 10pts each         | 250         |
| 14 topic quizzes, 20pts each           | 280         |
| 14 homework problems, 5 pts / question | 800         |
| bridge testing project                 | 250         |
| 12 recitation labs, 20 pts each        | 240         |
| <b>TOTAL</b>                           | <b>1820</b> |

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

|    |      |   |                |    |      |
|----|------|---|----------------|----|------|
| B+ | 1577 | A | 1698           | A- | 1638 |
| C+ | 1395 | B | 1516           | B- | 1456 |
| D+ | 1213 | C | 1334           | C- | 1274 |
|    |      | D | 1152           | D- | 1092 |
|    |      | E | 1091 and below |    |      |

By University policy the minimum passing grade for undergraduates is a D (1152) and for graduate students it is a C (1334).

# Course Schedule

## Lectures

Monday & Wednesday  
posted on website w/quiz

## Recitation

Friday – 12 Labs

## Exercise Problems

on course website

## Homework

on course website

## Topic Quizzes

weekly on Canvas

## Course Website

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

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

| DATES                      | TOPICS                                                                                                                                             | Reading (Onouye 4 <sup>th</sup> ed.)                                                                                                    | HW PROBLEMS                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| AUG 25<br>AUG 27<br>AUG 29 | Course Intro. Overview of Forces<br>Vertical Loads<br>Lateral Loads                                                                                | Ch. 1: pp. 1-14<br>Ch. 2.1: pp. 15-22                                                                                                   | Structures video TA 645.S78                                              |
| SEP 1<br>SEP 3<br>SEP 5    | <b>Topic Quiz 1</b><br><b>LABOR DAY ***** NO CLASS *****</b><br>Force Systems: Vector Addition<br>Recitation 1. Adding Forces                      | <b>LABOR DAY ***** NO CLASS *****</b><br>Ch. 2.2 & 2.3: pp. 23-41                                                                       | 1. Dead Load Calculation (8.31)<br><b>LABOR DAY ***** NO CLASS *****</b> |
| SEP 8<br>SEP 10<br>SEP 12  | <b>Topic Quiz 2</b><br>Force Systems: Moment of a Force<br>Force Systems: Equilibrium<br>Recitation 2. Moment of a Force                           | Ch. 2.3: pp. 42-60 Ch. 3.6: pp. 175-184<br>Ch. 2.4 – 2.6: pp. 61-95                                                                     | 2. Three Vector Addition (9.7)                                           |
| SEP 15<br>SEP 17<br>SEP 19 | <b>Topic Quiz 3</b><br>Equilibrium of Rigid Bodies<br>Cable Systems<br>Recitation 3. Equilibrium                                                   | Ch. 3.2: pp. 111-118<br>Ch. 3.1: pp. 96-110                                                                                             | 3. Moment of a Force (9.13)<br>4. Parallel Force Systems (9.14)          |
| SEP 22<br>SEP 24<br>SEP 26 | Catenary Arches and Shells + Bridge Project Introduction<br>Plane Trusses (by Joints)<br>Recitation 4. Truss Stability                             | Ch. 3.3: pp. 119-127                                                                                                                    | 5. Equilibrium of Rigid Bodies (9.21)                                    |
| SEP 29<br>OCT 1<br>OCT 3   | <b>Topic Quiz 4</b><br>Building Big – Bridges (video)<br>Plane Trusses (by Sections)<br>Recitation                                                 | Ch. 3.3: pp. 128-152<br>(interim bridge report due - 10.4)                                                                              | 6. Cable Systems (9.28)                                                  |
| OCT 6<br>OCT 8<br>OCT 10   | <b>Topic Quiz 5</b><br>Plane Trusses (by Graphic Statics)<br>Pinned Frames<br>Recitation 5. Graphic Statics                                        | Ch. 3.4: pp. 153-163                                                                                                                    | 7. Truss Systems (10.5)                                                  |
| OCT 13<br>OCT 15<br>OCT 17 | <b>Topic Quiz 6</b><br>***** FALL STUDY BREAK *****<br>Three Hinged Arches<br>Recitation 6. Three Hinged Arches                                    | Ch. 3.5: pp. 164-174                                                                                                                    | 8. Three Hinged Arches (10.19)                                           |
| OCT 20<br>OCT 22<br>OCT 24 | <b>Topic Quiz 7</b><br>Load Tracing & Floor Systems<br>Lateral Stability<br>Recitation 7. Lateral Stability                                        | Ch. 4.1: pp. 195-230<br>Ch. 4.2: pp. 231-250                                                                                            | 9. Floor Systems (10.26)                                                 |
| OCT 27<br>OCT 29<br>OCT 31 | <b>Topic Quiz 8</b><br>Stress and Strain<br>Elasticity and Deformation<br>Recitation 8. Elasticity                                                 | Ch. 5.1: pp. 251-266<br>Ch. 5.2-5.4: pp. 267-293                                                                                        | 10. Elastic Deformation (11.2)                                           |
| NOV 3<br>NOV 5<br>NOV 7    | <b>Topic Quiz 9</b><br>***** Bridge Testing *****<br>Cross-Sectional Properties<br>Recitation 9. Moment of Inertia                                 | Ch. 6.1 - 6.4: pp. 300-331                                                                                                              | 11. Moment of Inertia (11.9)                                             |
| NOV 10<br>NOV 12<br>NOV 14 | <b>Topic Quiz 10</b><br>Shear and Bending Forces pt1<br>Shear and Bending Forces pt2<br>Recitation 10. Moment Diagrams                             | Ch. 7.1-7.3: pp. 332-345<br>Ch. 7.4-7.5: pp. 346-364                                                                                    | 12. V & M Diagrams (11.16)                                               |
| NOV 17<br>NOV 19<br>NOV 21 | <b>Topic Quiz 11</b><br>Bending Stresses<br>Shear Stresses<br>Recitation 11. Shear Stress                                                          | Ch. 8.1-8.2: pp. 365-381<br>Ch. 8.1-8.2: pp. 365-381                                                                                    | 13. Horizontal Shear (11.23)                                             |
| NOV 24<br>NOV 26<br>NOV 28 | <b>Topic Quiz 12</b><br>video "When Engineering Fails"<br>***** THANKSGIVING BREAK *****<br>***** THANKSGIVING BREAK *****<br>No Quizzes this week | (final bridge report due – 11.26)<br>***** THANKSGIVING BREAK *****<br>***** THANKSGIVING BREAK *****<br>***** THANKSGIVING BREAK ***** |                                                                          |
| DEC 1<br>DEC 3<br>DEC 5    | <b>Topic Quiz 13</b><br>Deflection of Beams<br>Recitation 12. Deflection                                                                           | Ch. 8.3-8.4: pp. 382-401<br>Ch. 8.5: pp. 402-418                                                                                        | 14. Deflection of Beams (12.7)                                           |
|                            | <b>Topic Quiz 14</b>                                                                                                                               |                                                                                                                                         |                                                                          |

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Structures I

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# Course Website

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



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Structures

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Problems

Structures I - Arch 314 - Fall 2024  
9:30 - 10:30 MW - Rm 2104  
  
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Recitation Sections

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Structures I

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Lectures

M

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2022 Lectures



Topic Quizzes

| Lectures                     | Date   | w/Quiz | Video | Slides | Notes |
|------------------------------|--------|--------|-------|--------|-------|
| Course Intro                 | Aug 25 |        |       |        |       |
| Vertical Loads on Structures | Aug 27 |        |       |        |       |

Recitation Notes & Labs

M

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Notes & Videos from 2024:

Section Rosters:

| Recitation Topics: Labs | Notes/Video                  | Notes                    | Notes                      |
|-------------------------|------------------------------|--------------------------|----------------------------|
| Adding Forces           | Mohsen Vatandoost<br>002+003 | Amely Wackerbauer<br>004 | Faezeh Choobkar<br>005+006 |
| Moments of Forces       |                              |                          |                            |

## Project

## Problems



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## Problems

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# Computer Problems

## Problem Menu

Check Grades

Select Problem

Download Instructions

M

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Logged in as: Peter von Buelow

Problems

Check Points

Problem FAQ

| #     | Description                 | Due Date  | Current Scores                                                             |
|-------|-----------------------------|-----------|----------------------------------------------------------------------------|
| - 1 - | Dead Load Calculation       | 9-01-2024 | (1) 0/20 not completed<br>(2) 0/20 not completed<br>(3) 0/20 not completed |
| - 2 - | Three Vector Addition       | 9-08-2024 | (1) 0/50 not completed<br>(2) 0/50 not completed<br>(3) 0/50 not completed |
| - 3 - | Moment of a Force           | 9-13-2024 | (1) 0/30 not completed<br>(2) 0/30 not completed<br>(3) 0/30 not completed |
| - 4 - | Parallel Force Systems      | 9-15-2024 | (1) 0/25 not completed<br>(2) 0/25 not completed<br>(3) 0/25 not completed |
| - 5 - | Equilibrium of Rigid Bodies | 9-22-2024 | (1) 0/35 not completed<br>(2) 0/35 not completed<br>(3) 0/35 not completed |

# Computer Problems

M

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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: 1

-2-

-3-

Width: b

1.5 IN

Depth: d

9.25 IN

Length: L

7 FT

On center spacing

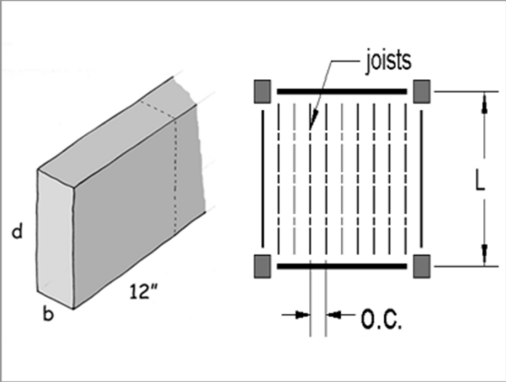
24 IN

Species class

Aspen

Density

25 PCF



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

Current Score: 0 / 20

# Structures

