

ARCHITECTURE 314

Structures I

Course Introduction:

Course Syllabus

Course Schedule

Online Resources

Introduction to Structures

Teaching Staff:

Prof.

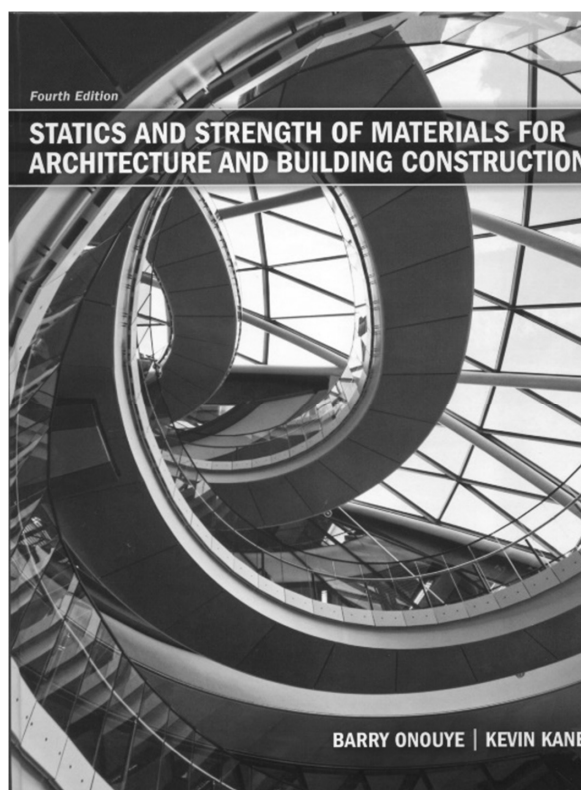
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GSIs:

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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 |
| TOTAL | 1820 |

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
pvbuelow@umich.edu
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 |
| TOTAL | 1820 |

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>

| DATES | TOPICS | Reading (Onouye 4 th ed.) | HW PROBLEMS |
|--------|--|---|--|
| AUG 25 | Course Intro. Overview of Forces | Ch. 1: pp. 1-14 | Structures video TA 645.S78 |
| AUG 27 | Vertical Loads | Ch. 2.1: pp. 15-22 | |
| AUG 29 | Lateral Loads | | 1. Dead Load Calculation (8.31) |
| SEP 1 | Topic Quiz 1 | | LABOR DAY ***** NO CLASS ***** |
| SEP 3 | Force Systems: Vector Addition | Ch. 2.2 & 2.3: pp. 23-41 | LABOR DAY ***** NO CLASS ***** |
| SEP 5 | Recitation 1. Adding Forces | | 2. Three Vector Addition (9.7) Scow |
| SEP 8 | Topic Quiz 2 | | |
| SEP 10 | Force Systems: Moment of a Force | Ch. 2.3: pp. 42-60 Ch. 3.6: pp. 175-184 | |
| SEP 12 | Force Systems: Equilibrium | Ch. 2.4 – 2.6: pp. 61-95 | 3. Moment of a Force (9.13) |
| SEP 15 | Recitation 2. Moment of a Force | | 4. Parallel Force Systems (9.14) |
| SEP 17 | Topic Quiz 3 | | |
| SEP 19 | Equilibrium of Rigid Bodies | Ch. 3.2: pp. 111-118 | |
| SEP 22 | Cable Systems | Ch. 3.1: pp. 96-110 | 5. Equilibrium of Rigid Bodies (9.21) |
| SEP 24 | Recitation 3. Equilibrium | | |
| SEP 26 | Catenary Arches and Shells + Bridge Project Introduction | Ch. 3.3: pp. 119-127 | 6. Cable Systems (9.28) |
| SEP 29 | Plane Trusses (by Joints) | | |
| OCT 1 | Recitation 4. Truss Stability | | |
| OCT 3 | Topic Quiz 4 | | |
| OCT 6 | Building Big – Bridges (video) | Ch. 3.3: pp. 128-152 | 7. Truss Systems (10.5) |
| OCT 8 | Plane Trusses (by Sections) | (interim bridge report due - 10.4) | |
| OCT 10 | Recitation 5. Graphic Statics | | |
| OCT 13 | Topic Quiz 5 | | |
| OCT 15 | Plane Trusses (by Graphic Statics) | Ch. 3.4: pp. 153-163 | |
| OCT 17 | Recitation 6. Three Hinged Arches | | |
| OCT 20 | Topic Quiz 6 | | |
| OCT 22 | Load Tracing & Floor Systems | Ch. 4.1: pp. 195-230 | 8. Three Hinged Arches (10.19) |
| OCT 24 | Lateral Stability | Ch. 4.2: pp. 231-250 | |
| OCT 27 | Recitation 7. Lateral Stability | | 9. Floor Systems (10.26) |
| OCT 29 | Topic Quiz 7 | | |
| OCT 31 | Stress and Strain | Ch. 5.1: pp. 251-266 | |
| NOV 3 | Elasticity and Deformation | Ch. 5.2-5.4: pp. 267-293 | |
| NOV 5 | Recitation 8. Elasticity | | |
| NOV 7 | Topic Quiz 8 | | |
| NOV 10 | Bridge Testing | Ch. 6.1 - 6.4: pp. 300-331 | 10. Elastic Deformation (11.2) |
| NOV 12 | Cross-Sectional Properties | | |
| NOV 14 | Recitation 9. Moment of Inertia | | 11. Moment of Inertia (11.9) |
| NOV 17 | Topic Quiz 9 | | |
| NOV 19 | Shear and Bending Forces pt1 | Ch. 7.1-7.3: pp. 332-345 | |
| NOV 21 | Shear and Bending Forces pt2 | Ch. 7.4-7.5: pp. 346-364 | |
| NOV 24 | Recitation 10. Moment Diagrams | | 12. V & M Diagrams (11.16) |
| NOV 26 | Topic Quiz 10 | | |
| NOV 28 | Bending Stresses | Ch. 8.1-8.2: pp. 365-381 | |
| DEC 1 | Shear Stresses | Ch. 8.1-8.2: pp. 365-381 | |
| DEC 3 | Recitation 11. Shear Stress | | 13. Horizontal Shear (11.23) |
| DEC 5 | Topic Quiz 11 | | |
| DEC 8 | video "When Engineering Fails" | (final bridge report due – 11.26) | |
| DEC 10 | THANKSGIVING BREAK ***** | | |
| DEC 12 | THANKSGIVING BREAK ***** | | |
| DEC 14 | THANKSGIVING BREAK ***** | | |
| DEC 16 | THANKSGIVING BREAK ***** | | |
| DEC 18 | THANKSGIVING BREAK ***** | | |
| DEC 20 | THANKSGIVING BREAK ***** | | |
| DEC 22 | THANKSGIVING BREAK ***** | | |
| DEC 24 | THANKSGIVING BREAK ***** | | |
| DEC 26 | THANKSGIVING BREAK ***** | | |
| DEC 28 | THANKSGIVING BREAK ***** | | |
| DEC 30 | THANKSGIVING BREAK ***** | | |
| DEC 31 | THANKSGIVING BREAK ***** | | |
| DEC 3 | Deflection of Beams | Ch. 8.3-8.4: pp. 382-401 | |
| DEC 5 | Recitation 12. Deflection | Ch. 8.5: pp. 402-418 | 14. Deflection of Beams (12.7) |
| DEC 7 | Topic Quiz 12 | | |

Course Website

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



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Architecture

Structures

Contact

Contact

Schedule

Lectures

Recitation

Bridges1

Bridges2

Problems

Structures I - Arch 314 - Fall 2024

9:30 - 10:30 MW - Rm 2104

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 USA
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Recitation Sections

Lectures

M

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2022 Lectures



WEEKLY
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 002+003 | Amely Wackerbauer 004 | Faezeh Choobkar 005+006 |
| Moments of Forces | | | |

Bridge Project

M

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Project

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Bridge Project Brief 2024

Prelim Report Guidelines 2024

Final Report Guidelines 2024

Scoring Rubric 2024

Examples of Bridge Types

Example Reports

Dr. Frame Software (download)

Dr. Frame Tutorial

Dr. Frame User's Guide

West Point Bridge Designer

Videos of Bridge Testing





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Structures I

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Computer Problems

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

Uniqname

UMID >>**Number**<< (NOT Kerberos)

M

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Problems

ContactScheduleLecturesRecitationBridges1Bridges2Problems

You must supply a uniqname.

Please login to access this page:

username:

UMID#:

Login

or login with
username = guest
and UMID# = 123

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Structures I

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Computer Problems

Problem Menu

Check Grades

Select Problem

Download Instructions

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Bridges1

Bridges2

Problems

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
(2) 0/20 not completed
(3) 0/20 not completed

- 2 -

Three Vector Addition

9-08-2024

(1) 0/50 not completed
(2) 0/50 not completed
(3) 0/50 not completed

- 3 -

Moment of a Force

9-13-2024

(1) 0/30 not completed
(2) 0/30 not completed
(3) 0/30 not completed

- 4 -

Parallel Force Systems

9-15-2024

(1) 0/25 not completed
(2) 0/25 not completed
(3) 0/25 not completed

- 5 -

Equilibrium of Rigid Bodies

9-22-2024

(1) 0/35 not completed
(2) 0/35 not completed
(3) 0/35 not completed

Computer Problems

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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

Depth: d

Length: L

On center spacing

Species class

Density

1.5 IN

9.25 IN

7 FT

24 IN

Aspen

25 PCF

1 d

A

b

12"

joists

L

O.C.

#

Question

Your Response

Correct Answer

Score

1

The cross-sectional area: A

32.345 IN^2

SUBMIT

2

Dead load of joist section

SUBMIT

3

Dead load of whole joist member

SUBMIT

4

Dead load of joists on floor

SUBMIT

Current Score: 0 / 20

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Structures I

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Structures

