

CVET-434-01 Design of Highway Bridges *Spring 2018*

Instructors: **Dr. Amanda Bao, P.E.**

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Lecture: **M, W, F: 12:20-1:15pm, Room ENT-2165**

Office Hours: **T: 2:30-3:30pm; W: 1:30-2:30pm; F: 11:00am-Noon in ENT-3154**

Text:

1. Design of Highway Bridges: An LRFD Approach, by Richard M. Barker and Jay Alan Puckett, 3rd Edition, John Wiley & Sons, 2013

References:

1. AASHTO LRFD Bridge Design Specifications, 5th Edition

Prerequisites:

Structural Analysis (CVET-332)

Structural Design – Steel (CVET-431) and/or Structural Design – Reinforced Concrete (CVET-432)

Intended Learning Outcomes:

After completing this course, you will be able to:

1. Calculate design loads on bridges and calculate live load distribution Identify vertical and lateral load paths in bridges.
2. Design bridge superstructure including prestressed concrete girders, steel girders and reinforced concrete deck per AASHTO LRFD code.
3. Design bridge substructure including abutment and foundation.
4. Prepare project design and construction documents such as structural plans, sections, details and project cost estimates.

Course Outline:

1. Introduction and types of bridges (3 lectures)
2. Bridge design considerations (2 lectures)
3. Design loads on bridges (6 lectures)
4. Reinforced concrete deck design (5 lectures)
5. Design of prestressed concrete girders using CONSPAN (9 lectures)
6. Design of I-plate steel girders using MDX (9 lectures)
7. Abutment design (3 lectures)
8. Bridge foundation design (2 lectures)
9. Project presentation (1 lecture)
10. Tests (2 lectures)

Homework Assignments:

Homework assignments can be carried out in a group of 2 students or individually if preferred. Students are encouraged to form their own groups. Homework assignment will be given on a bi-weekly basis. Refer to the homework assignment file on the course website at <http://mycourses.rit.edu>.

- **Homework problems are due by 4pm on the assigned due date. No late homework will be accepted or graded.**
- Calculations should be neat and organized. Sketches, assumptions, units, and references must be included, where appropriate. Show all works in details. Use Engineering paper only, write on one side and box your solutions. All numerical values shall include the appropriate units. Points will be deducted from the assignment grade if this format is not followed.
- No point will be given for work that has been copied from other students or resources.
- Homework will be assigned group grades.
- Solutions to the homework assignments will be posted in the display case outside CETEMS office.

Homework Assignments Schedule:

| Homework # | Handout Date | Due date | Topic |
|------------|--------------|--------------|---|
| 1 | Fri. 1/19/18 | Fri. 2/2/18 | Bridge types and selection |
| 2 | Fri. 2/2/18 | Fri. 2/16/18 | Design loads on bridges |
| 3 | Fri, 2/16/18 | Mon, 3/5/18 | Influence lines; Live load distribution |
| 4 | Mon. 3/5/18 | Wed. 3/21/18 | Reinforced concrete deck |
| 5 | Wed. 3/21/18 | Wed. 4/4/18 | Prestressed concrete girder |
| 6 | Wed. 4/4/18 | Fri. 4/20/18 | Steel girder |
| 7 | Fri. 4/20/18 | Wed. 5/2/18 | Abutment & pile design |

Design Project

- A group design project will be assigned in this course and a formal design project report (including detailed design calculations) with CAD drawings is required.
- The design project will be carried out in a group of **3 or 4** students. Students are encouraged to form their own teams, and the names of the company and team members should be submitted to the instructor by **Friday, January 26, 2018**.
- MS Excel spreadsheets/ Hand calculations are encouraged to use in the steel member design and strength check.
- Each team member is expected to put in equal amount of effort and must identify his/her portion of the design project report.
- Each team member will be required to make an oral presentation of their design project.
- To evaluate individual contributions to the team's effort, the members in each team will be required to submit peer reviews and evaluations within their group together with their design project report.
- The design project will be assigned group grades.

Conduct in Lectures:

Please be on time and conduct yourself in a respectful and professional manner in class. Students will refrain from wearing headphones, earpieces, or other audio devices during class. Laptops can only be used during class for note-taking purposes. Cell phones, pagers, texting devices, I-pods, etc. should be set to silent mode.

Computer Usage:

STAAD will be used for structural analysis in the design project. Bentley CONSPAN and MDX software will be used to design bridge girders. AutoCAD, Revit or MicroStation will be used for plan production in the design project.

Course Web Site, Online Discussions, and E-mail:

The course web site at <http://mycourses.rit.edu> will mainly be used to post handouts, homework and project information. Structural Analysis and STAAD screencasts are available on the web site: <http://baoteachingcet.com>. (Screencasts Access: **Username: test, Password: 1234**) Some announcements relating to this course may be sent to you via e-mail.

Exams:

There will be **two** 55-min mid-term tests in this course, and the exams are open book and open notes.

Exams Schedule: (Exams are open book and open notes)

| Exam # | Date | Covers HW # |
|--------|--------------|-------------|
| 1 | Fri. 3/2/18 | 1, 2 |
| 2 | Fri. 4/13/18 | 3, 4, 5 |

Note: No make-up tests will be given except in **very extenuating** circumstances and only if the instructor is given prior notice. **The exams will not be returned** but you may look through your graded exam booklet in my office.

Grade Distribution:

| | |
|------------------------------------|-------|
| Homework | = 20% |
| Two Mid-Term Tests@ 20% each | = 40% |
| Design Project Report/Presentation | = 40% |

Letter Grades:

The letter grades in this course will be assigned as follows:

| | | |
|-----------|---|----------|
| A | = | 93-100 |
| A- | = | 90-92 |
| B+ | = | 87-89 |
| B | = | 83-86 |
| B- | = | 80-82 |
| C+ | = | 77-79 |
| C | = | 73-76 |
| C- | = | 70-72 |
| D | = | 60-69 |
| F | = | Below 60 |