



INSTRUCTOR INFORMATION

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COURSE INFORMATION

Course Description: Basic introduction to the mathematical foundations of statics – equilibrium, balance, centroids, neutral axis – with primary focus on developing a basic understanding of concepts of conditions of equilibrium and force systems.

Prerequisites/enrollment restrictions: Open only to B.ARCH., BA/BS in Architecture, and BA/BS in Environmental Design.

Course Objectives: In this course, students will perform a series of engineering calculations aimed at the technical analysis of discrete structural components, specifically pin-connected, multi-force structures; beams; and trusses. Throughout the semester, students should keep in mind that the calculations and analytical processes they learn are meant to demonstrate fundamental principles related to how structures actually and physically function in the real world. To that end, an overarching aim of this course is not only to help students learn the technical details of building structures but also to develop an *intuitive sense* for the subject. You will develop such a sense of through class-wide problem-solving sessions, class discussions, and a semester-long structural design project (i.e., a steel bridge).

In terms of technical subjects, each student is expected to demonstrate a working knowledge (via calculations, class discussions, and the semester project) of the following topics:

- force vectors using graphical and algebraic techniques, right angle trigonometry, and concurrent force systems

- beam action, to include bending, compression and tension in relation to a beam's neutral axis, point loads (P) and uniformly distributed loads (w), beam supports and reactions, static equilibrium and the standard equilibrium equations ($\Sigma F_x = 0$, $\Sigma F_y = 0$, and $\Sigma M = 0$), shear forces and shear force diagrams, bending moments and bending moment diagrams, and a beam's maximum bending moment M_{max} and its Elastic Section Modulus S_x
- trusses and coplanar force systems with an emphasis on the method of joints, and sizing of discrete truss components through the basic stress equation $f = P/A$
- the links associated with rules of thumb and the baseline calculations that can lead to initial size requirements for a range of structural components (i.e., planks, joists, beams, laminated beams, trusses, columns, walls, and arches)
- the analysis of existing structures and/or design of proposed structural systems

COURSE MATERIALS

Textbooks, learning resources, and reading assignments

There is no required textbook for this course. There are, however, three recommended references. The first is *Simplified Engineering for Architects and Builders* (12th Edition) by James Ambrose and Patrick Tripeny. **An online version is available through our Architecture Library.** The second book is *Statics and Strengths of Materials for Architecture and Building Construction* by Barry Onouye and Kevin Kane. You may want to become familiar with both of these books, as they treat many topics in different manners and to different levels of detail.

The third book may be the best structures book ever written for architecture students. It is *Structures* by Daniel Schodek. It is available in different editions with different cowriters. In any case, these books are invaluable resources, not only for this semester but also over your architecture career. They should be especially useful between graduation and the time that you take the Architectural Record Exam. Thus, I highly recommend that you rely on any one or all now and in the future.

Lastly, in preparing my lectures, your homework problems, and other class materials, I will rely on a number of other textbooks, all of which are excellent resources to you as well. These include the following:

- Edward Allen and Joseph Iano, *The Architect's Studio Companion*, 5th; and *Fundamentals of Building Construction*, 4th Ed.
- Francis D.K. Ching, Barry S. Onouye, and Douglas Zuberbuhler, *Building Structures Illustrated*, 2nd Edition.
- Mario Salvadori, *Why Buildings Stand Up*.

Any of the books listed above would make excellent additions to your own architectural library.

Calculator: You will not be allowed to use the calculators in your smart phones during a quiz or the final exam. So, you will need to acquire a calculator that at the very least supports simple mathematic operations. Such calculators are readily available for a low price at any of a number of retailers.

Use of other electronic devices: You are free to use your laptops, tablets, and smartphones during class lectures, as long as you are using them to help you in class. Checking social media, texting, working on other classes, and other such activities are distracting to others and counterproductive to your learning in class, and thus are not allowed.

COURSE ASSIGNMENTS AND ASSESSMENTS

Semester Project: This semester each student will complete a structural design of a steel bridge, with an emphasis on sizing structural components (e.g., beams, decks, trusses) using rules of thumb. I will hand out this project assignment within the first three weeks of class. You will submit process checks for this project digitally via Canvas at prearranged intervals. I will provide feedback online and review the class's progress during the class lectures. At the end of the semester each student will submit their final project via Canvas.

Homework and quizzes: These graded assignments will be announced in class regularly throughout the semester. Homework assignments and quiz announcements will be included in the lecture slides posted on Canvas.

Confidence and mastery of building structures come with the repeated application of principles through verifiable, technical problems. Thus, *I intend to assign you regular homework problems.* The homework problems have a dual purpose – to gauge your progress, and to reinforce the course goals and objectives through constant practice. If at any time you find that you need help with your homework or other course requirements, please come see me for individual or small group (two to three people) assistance. But remember, I am here to help you, not to do the work for you.

In addition to your homework, you will have a small number of quizzes interspersed throughout the semester. These quizzes are a last check to make sure that you can complete certain structures problems on demand. Quizzes will be announced with at least a 1-week notice.

Finally, your homework and quizzes are worth 70% of your final grade, which is a lot! The purpose of this is to set you up for success. But be warned, if you habitually fail to turn in your homework or miss a quiz, it can lead to your undoing in this course.

All quizzes are open notes and open book (either your recommended textbook or any other books of your choice): Open note and open book quizzes have their pitfalls. Most notably, some students think that they do not need to prepare for a quiz as rigorously as they normally would because they can always fall back on their notes or a book. This is a mistake. On the other hand, the best students will be ready to answer the quiz questions and work the structures problems in such a way that they will need to rely *very little or not at all* on their notes or textbook.

Special final exam policy: *Your final exam will not be open notes/open book.* You will be allowed two physical pages of notes and sample problems for reference. Each of your two pages will be no larger than 8.5" x 11", and you may write on the front and back of each page.

Grade breakdown

Homework and quizzes _____ 70%
In-person, cumulative final exam _____ 15%
Semester project _____ 15%

Finally, letter grades will be determined using the following scale:

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|-----------|--------------------------|-----------|------------------------|
| A | $92.5 \leq A \leq 100\%$ | C | $72.5 \leq C < 77.5\%$ |
| A- | $90 \leq A- < 92.4\%$ | C- | $70 \leq C- < 72.5\%$ |
| B+ | $87.5 \leq B+ < 90\%$ | D+ | $67.5 \leq D+ < 70\%$ |
| B | $82.5 \leq B < 87.5\%$ | D | $62.5 \leq D < 67.5\%$ |
| B- | $80 \leq B- < 82.5\%$ | D- | $60 \leq D- < 62.5\%$ |
| C+ | $77.5 \leq C+ < 80\%$ | F | $< 60\%$ |

Late homework – a documented family or medical emergency are the only acceptable excuses for a late homework without a grade penalty. Such a situation must be communicated in writing (via e-mail) to the instructor **BEFORE** the homework is due. Otherwise...

- All late homework will have 10% deducted from the final grade.
- After 24 hours late: total 20% off.
- After 48 hours late: total 30% off.
- After 72 hours late: total 40% off.
- After 96 hours late: total 100% late.

Once an assignment due date has passed, **you will not have the option to resubmit an assignment for a higher grade**. There are also **no extra credit assignments planned for this semester**. If any extra credit assignments are given, they will be made available to the entire class, not for any single individual.

Lastly, **if 96 hours after a homework deadline has passed, and further if you realize that your homework did not upload to Canvas, you will receive a 0 for that assignment**. Please verify that when you submit an assignment to Canvas, your submission is in fact online and ready to be graded.

UNIVERSITY STATEMENTS AND OTHER CLASSROOM POLICIES

University Statement: We are committed to ensuring that all members of the community are welcome, through valuing the various experiences and worldviews represented at Ball State and among those we serve. We promote a culture of respect and civil discourse.

Disability Statement: If you need course adaptations or accommodations because of a disability, please contact the instructor of record as soon as possible. Ball State's Disability Services Office coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability Services can be contacted at 765-285-5293 or dsd@bsu.edu.

Attendance: Generally, missing class is directly related to your performance and final grade in the course. Put another way, **the more classes that you miss, the more that it will negatively affect your performance, understanding of the class contents, and final grade.** This is especially the case in the Arch 218/318 sequence. So, missing any classes is almost sure to set you back. This will be especially so if you miss course content that I present in only one class session and then expect you to apply it in subsequent classes.

Academic integrity: I encourage each of you to study and work together to get the most out of this course. Even a small group composed of two students will help you to navigate some of the difficult material and homework problems that you are expected to learn. However, I expect that all homework that each of you turns in will be your own. Do not copy each other's work for the sake of completing an assignment. Also, during quizzes, please do not communicate with one another beyond what is minimally required (for example, passing a copy of the quiz to your neighbor, etc.) If you require assistance during a quiz, do not ask your neighbor. Instead, ask the instructor or the graduate assistant (if present).

Use of Generative Artificial Intelligence Technology (AIT): Generative AI technology has arisen over the past year as a new leap forward in the evolution of computing capability. Proponents and experts on this technology regularly insist upon its ethical and responsible use. This last assertion could not be more relevant in the classroom or design studio. Thus, this semester we will observe specific limits on the use of this technology. Those limits are outlined below.

- You are not permitted to include any AI-generated **text** in any of your graded assignments.
- You may not utilize AIT to mathematically solve any **calculations** or answer any homework questions in this course.
- If you choose to utilize any **graphics or images** generated by an AIT, including presentation board layouts, you will be required to cite such work. Citations must be a part of an image caption or presentation board title (depending on how you used the AIT), and must be a minimum of 10 pt font size.