ARCH 331. Foundations Structures

Instructor: Prof. Anne B. Nichols
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Office Hours: 12;30-2 pm MW,
1-2 pm TR
(*and by appointment M-R)*

Catalogue Description: Introduction to the physical principles that govern statics and strength of materials through the design of architectural structures from a holistic view in the context of architectural ideas and examples. Introduction to construction, behavior, and design considerations for simple and complex structural assemblies; computer applications. Concurrent enrollment in ARCH 305. Prerequisites: MATH 142 or equivalent, PHYS 201.

Goals: ARCH 331 is the study of structural design concepts that influence the development of architectural space and form. In all construction, the component parts of a structure must be assigned definite physical sizes, constructed of specific materials and designed to resist various load combinations. The course is divided into three parts: Statics, Strength of Materials, and Design. **Statics** involves the study of external forces and the effects of these forces on bodies or structural systems in equilibrium (at reset or moving with a constant velocity). **Strength of Materials** involves analytical methods for determining the strength, stiffness (deformation characteristics), and stability of the various load-carrying members. **Design** involves planning, assessing, and meeting structural requirements of parts or the whole which are prescribed by building codes and material structural design specifications.

Objective: To understand the significance, assumptions, applications, and limitations of the basic principles of Statics and Strength of Materials as they apply to the design and analysis of structural members and systems within the context of architectural planning and design.

Text: Statics and Strength of Materials –Foundations for Structural Design, Onouye, (2005) Pearson - Prentice Hall, ISBN 0-13-111837-4

Recommended Texts:
A Structures Primer, Kaufman, (2010) Prentice Hall, ISBN 978-0-13-230256-3
Understanding Structures, Moore, (1999) McGraw-Hill, ISBN 13 9780070432536

Reference: ACI 318-02 Code and Commentary
AISC 3rd ed. Load and Resistance Factor Design
AISC 9th ed. Allowable Stress Design
National Design Specifications for Wood

Timetable:

CREDIT 3.0 (2:2)	11:10 am - 12:25 pm	Lecture	T,R	
(section 500)	12:45 - 2:00 pm	Lab	T,R	(1:40 total)

Grading: The levels listed for graded work (projects, quizzes, exams) and pass-fail work (assignments) ***must both be met*** to earn the course letter grade:

Letter Grade	*Graded work*	*Pass-fail work*
A	A average (90-	Pass for 90 to 100%of

	100%)	assignments
B	B average (80-89%)	Pass for 83 to 100% of assignments
C	C average (70-79%)	Pass for 75 to 100% of assignments
D	D average (60-69%)	Pass for 65 to 100% of assignments
F	F average (<59%)	Pass for 0% to 100% of assignments

Graded work: This typically constitutes 6 quizzes, a learning portfolio (worth 1.5 quizzes) and a final exam (worth 4 quizzes). This equates to proportions of approximately 52% to quizzes, 13% to the learning portfolio, and 35% to the final exam.

Pass/fail work: This constitutes all practice assignments and projects, each with a value of 1 unit. Criteria for passing is *at least* 75% completeness and correctness along with every problem attempted. Percent effort expected for a problem in a practice assignment is provided on the assignment statement. This is considered a lab course and the assignments **are required work** with credit given for competency. The work is necessary to apply the material and prepare for the quizzes and exam. It is expected that this work will be completed with assistance or group participation, but all *graded* work is only by the individual.

Policy: 1) Attendance: Necessary. Required.* And subject to University Policy. See Part I Section 7 in Texas A&M University Student Rules: http://student-rules.tamu.edu/ Absences related to illness or injury must be documented according to http://shs.tamu.edu/attendance.htm *including* the Explanatory Statement for Absence from class for 3 days or less. Doctors visits not related to immediate illness or injury are not excused absences.

2) **Lecture, Lab and Textbook:** The lecture slide shows that correspond to the Notes (see #Date Name Course are to be viewed prior to lecture which will be reserved for review of the full lecture and text reading. Lab will consist of problem solving requiring the textbook. The lecture shows are available on the class web page and Vista (see #Vista: Vista is a web course tool for posting, reading messages and replying as well as recording scores and is accessed with your neo account. This will be used to post questions and responses by class members and the instructor, for posting scores and for e-mail. It can be accessed at http://elearning.tamu.edu/. Attendance is required for both lecture and lab.

Date Name Course

Given:
Find:
Solution:
:

Format:

Notes: The notes and related handouts are available on the class web page at http://archone.tamu.edu/faculty/anichols/index_files/courses/arch331/index.html, or on Vista (see #Vista: Vista is a web course tool for posting, reading messages and replying as well as recording scores and is accessed with your neo account. This will be used to post questions and responses by class members and the instructor, for posting scores and for e-mail. It can be accessed at http://elearning.tamu.edu/. A full set can be purchased from the TEES copy center located on the

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second floor of Wisenbaker Engineering Research Lab. They are listed under Anne Nichols, ARCH 331.

3) **Assignments:** Due as stated on the assignment statements. Only *one* assignment without University excuse may be turned in for credit no later than one week after the due date. All other assignments and projects will receive *no credit* if late without a recognized excuse or after final exams have begun. Assignments with incorrect formatting will be penalized.

4) **Quizzes:** Quizzes will be given at any time during the period. Make-up quizzes without an excuse will not be given. Practice quizzes will be posted electronically. No quiz scores will be "dropped".

5) **Teaching Assistant:** Caleb Spangenburger.....(calebspang@neo.tamu.edu)

6) **Structures Help Desk:** Mark Navarro.....(markinarch@neo.tamu.edu)
ARCC02 845-6580

7) **Vista:** Vista is a web course tool for posting, reading messages and replying as well as recording scores and is accessed with your neo account. This will be used to post questions and responses by class members and the instructor, for posting scores and for e-mail. It can be accessed at http://elearning.tamu.edu/

8) **Final Exam:** The final exam will be comprehensive, and is officially scheduled for:
3:00-5:00 PM, Friday, May 7 (by lecture time)

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9) **Other Resources:** The Student Learning Center provides tutoring in math and physics. See their schedule at http://slc.tamu.edu/tutoring.shtml

10) **Aggie Honor Code:** "An Aggie does not lie, cheat, or steal or tolerate those who do."

The University policy will be strictly enforced. See Part I Section 20 in Texas A&M University Student Rules: http://student-rules.tamu.edu/ Plagiarism (deliberate misrepresentation of someone else's work as your own) will be treated strictly according to University policy as outlined by the Office of the Aggie Honor System: http:/www.tamu.edu/aggiehonor/

11) **The American with Disabilities Act** (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please contact the Department for Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637. Also contact Prof. Nichols at the beginning of the semester.

12) **Grievances:** For grievances other than those listed in Part III in Texas A&M University Student Rules: http://student-rules.tamu.edu/ the *instructor* must be the first point of contact.

Learning Objectives:

1) The student will be able to read a text or article about structural technology, identify the key concepts and related equations, and properly apply the concepts and equations to appropriate structural problems (**relevance)**. The student will also be able to define the answers to key questions in the reading material. The student will be able to evaluate their own skills, or lack thereof, with respect to reading and comprehension of structural concepts, **clarity** of written communication, reasonable determination of **precision** in numerical data, and **accuracy** of computations.

2) The student will be able to read a problem statement, interpret the structural wording in order to identify the concepts and select equations necessary to solve the problem presented (**significance)**. The student will be able to identify common steps in solving structural problems regardless of the differences in the structural configuration and loads, and apply these steps in a clear and structured fashion (**logic)**. The student will draw upon existing mathematical and geometrical knowledge to gather information, typically related to locations and dimensions, provided by representational drawings or models of structural configurations, and to present information, typically in the form of plots that graph variable values. The student will be able to draw representational structural models and diagrams, and express information provided by the figures in equation form. The student will compare the computational results in a design problem to the requirements and properly decide if the requirements have been met. The student will take the corrective action to meet the requirements

3) The student will create a structural model with a computer application based on the concepts of the behavior and loading of the structural member or assemblage. The student will be able to interpret the modeling results and relate the results to the solution obtained by manual calculations.

4) The student will be able to articulate the physical phenomena, behavior and design criteria which influence structural space and form. (**depth)** The student will be able to identify the structural purpose, label, behavior, advantages and disadvantages, and interaction of various types of structural members and assemblies. (**breadth)** The student will create a physical structure or structures using non-traditional building materials, considering material and structural behavior, in order to demonstrate the behavior and limitations of a variety of structural arrangements. The student will produce proper documentation and drawings of the size, spacing, location and connection of parts for the construction of the structure.

5) The student will interact and participate in group settings to facilitate peer-learning and teaching. In addition, the student will be able to evaluate the comprehension of concepts, clarity of communication of these concepts or calculations, and the precision and accuracy of the data used in the computations in the work of their peers.

Tentative Schedule *(subject to change at any time throughout the semester)*

Lecture	Text TopicArticles/ Problems	
	Design Loads and Structural Performance Requirements	**Read*:** Ch. 1, § 5.1 **Solve:** Assignment 1 (*start*)
	Structural Systems, Planning and Design	**Read:** Appendix B; note sets 2.1, 2.2, 2.3 & 2.4 **Reference:** *note set 2.5*
	Forces and Moments	**Read:** Ch. 2; note sets 3.1 & 3.2 **Due:** Assignment 1
	Equilibrium of a Point & Analysis of Planar Trusses	**Read:** § 3.1, pg. 89-95; note set 4.1 **Reference:** *note set 4.2*
	Rigid Body Equilibrium & Analysis of Planar Trusses	**Read:** § 3.2, 3.3, pg. 98-110; note sets 5.1 & 5.2 **Due:** Project
	Mechanics of Materials	**Read:** Ch. 6; note sets 6.1, 6.2 & 6.3 **Due:** Assignment 2
	Beam Shear and Bending	**Read:** § 8.1-8.2, note set 7 **Quiz 1**
	Semi-graphical Method: Shear and Bending Moment Diagrams	**Read:** § 8.3-8.4; (note set 7) **Reference:** *note sets 8.1 & 8.2* **Due:** Assignment 3
	Beam Section Properties	**Read:** § 7.1-7.4; note sets 9.1 & 9.2
	Beam Stresses	**Read:** § 9.1-9.4; note set 10 **Due:** Assignment 4
	Other Beams and Pinned Frames	**Read:** § 4.2, pg 73; note set 11 **Quiz 2**
	Rigid Frames - Compression & Buckling	**Read:** § 10.1,10.2 & 10.5; note sets 12.1 & 12.2 **Reference:** *note set 12.3* **Due:** Assignment 5
	Design Loads, Codes and Methodology	**Read:** § 5.1; note set 13.1 **Reference:** *note sets 13.2, 13.3, 13.4, 13.5*
	System Assemblies and Load Tracing	**Read:** § 5.2, 5.3, 4.4; note set 14 **Due:** Assignment 6
	Wood Construction Materials & Beam Design	**Read:** § 9.5-9.6; note sets 15.1 & 15.2 **Quiz 3**
	Column Design	**Read:** § 10.4; note set 15.1 **Due:** Assignment 7
	Joints and Connection Stresses	**Read:** note set 15.1

*Note: Materials in the Class Note Set not specifically mentioned above are provided as references or aids

Steel Construction Materials & Beam Design	**Read:** note set 18 **Due:** Assignment 8
Trusses, Decks & Plate Girders	**Read:** pg. 98-110; note set 18 **Reference:** *note set 5.2* **Quiz 4**
Column Design & Tension Members	**Read:** § 10.3; note set 18 **Due:** Assignment 9
Bolted Connections & Welds	**Read:** note set 18
Concrete Construction Materials & Beam Design	**Read:** note set 22.1 **Reference:** *note set 22.2* **Due:** Assignment 10
T-beams & Slabs	**Read:** note set 22.1 **Quiz 5**
Shear, Torsion, Reinforcement & Deflection	**Read:** note sets 22.1 & 24 **Due:** Assignment 11
Floor Systems & Continuous Beams	**Read:** note sets 22.1 & 25.1 **Reference:** *note set 25.2*
Columns & Frames	**Read:** note set 22.1 **Due:** Assignment 12
Foundation Design & Footings	**Read:** note sets 27.1 & 27.2 **Quiz 6**
Masonry Construction Beams & Columns	**Read:** note set 28.1 **Reference:** *note sets 28.2 & 28.3* **Due:** Assignment 13 & Learning Portfolio
Final Exam Period	**Exam**

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