ARCH 614. Elements of Architectural Structures

Instructor: Prof. Anne B. Nichols
A413 Langford
(979) 845-6540
anichols@tamu.edu

Office Hours: 12:30-2 pm MW
1-2 pm TR
(*and by appointment M-R)*

Prerequisites: ARCH 612, Math (Basic, Geometry, Linear Algebra)

Catalogue Description: Investigation of the structural factors that influence the development of architectural space and form; introduction of the physical principles that govern statics and strength of materials through design of timber and steel components of architectural structures.

Goals: ARCH 614 is the study of structural design concepts that influence the development of architectural space and form. In all engineering 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 two parts: Statics and Strength of Materials. **Statics** is the branch of mechanics that 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. Members are designed for specific materials using current national design specifications. The form of structures and the relations to structural members will be studied.

Objective: To develop an understanding of 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 simple connections.

Text: Simplified Engineering for Architects and Builders, 11th ed., Ambrose & Tripeny, (2011) Wiley, ISBN 978-0-470-43627-1 (hardcopy) or ISBN 978-0-470-91339-0 (digital)

Suggested Text: Understanding Structures, Moore, (1999) McGraw-Hill, ISBN 13 9780070432536

Reference: ACI 318-11 Code and Commentary
AISC 14th ed. Steel Construction Manual
Masonry Joint Structural Code
National Design Specifications for Wood

Timetable:

CREDIT 3.0 (2:2)	8:00-9:15 am	Lecture	T,R	
(section 600)	9:25-10:50 am	Lab	T,R	(1:40 total)

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

Letter Grade	*Graded work*	*Pass-fail work*
A	A average (90-100%)	Pass for 90% to 100% of 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 10 quizzes, a learning portfolio (worth 1.5 quizzes) and a final exam (worth 4 quizzes). This equates to proportions of approximately 64.5% to quizzes, 9.7% to the learning portfolio, and 25.8% 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 #3) 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 #6). Attendance is required for both lecture and lab. *Use of electronic devices during lecture/lab is prohibited.*

3) **Notes:** The handouts are available on the class web page at http://faculty.arch.tamu.edu/anichols/614frame.html, or on Vista (see #8) A bound set can be purchased from the Notes-n-Quotes at 701 W. University, directly across from the Mitchell Physics Building in the Northgate Neighborhood.

4) **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 **and** before final exams begin. . 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.

Format:

Date Name Course
Given:
Find:
Solution:
:

5) **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". *Use of cell phones with calculator applications during quizzes and exams is prohibited*

6) **Teaching Assistant:** Kara Wetzel ..... (kewetz@neo.tamu.edu)

7) **Structures Help Desk:** Ryan Buys..... (syubnayr@neo.tamu.edu)
ARCA129 845-6580 Posted Hours (link)

8) **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/

9) **Final Exam:** The final exam will be comprehensive, and is officially scheduled for ***1-3 PM, Monday, May 6*** (by lecture time).

* Except for death in the family, medical or deans' excuse, and natural disasters.

10) **Other Resources:** The Student Learning Center provides tutoring in math and physics. See their schedule at http://slc.tamu.edu/tutoring/ The Student Counseling Center has programs for study and learning (PASS), and tutoring services. See the resources at scs.tamu.edu

11) **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/

12) **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.

13) **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 be able to identify the configuration, label, behavior, advantages and disadvantages, and interaction of various types of structural members and assemblies with respect to materials (e.g. reinforced concrete beams or frames).

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 Topic	Articles/ Problems
1.	Structural Performance Requirements, Systems, Math and Applied Physics	**Read*:** Text Introduction (pp. 1-7); note sets 1.1, 1.2 & 1.3 **Practice:** *Math Worksheets*
2.	Forces	**Read:** Text 1.1-1.4; note set 2
3.	Equilibrium, Free Body Diagrams & Analysis of Planar Trusses	**Read:** Text 2.6; note set 3.1 **Reference:** *note set 3.2* **Solve:** Assignment 1 (*start*)
4.	Response to Forces and Temperature	**Read:** Text 2.1, 2.2, 3.1; note set 4
5.	Moments, Rotational Equilibrium & Beam Reactions	**Read:** Text 1.5-1.7; note set 5 **Due:** Assignment 1 & Project Part I
6.	Beam Shear and Bending	**Read:** Text 3.2-3.5; note set 6.1 **Reference:** *note set 6.2*
7.	Semi-graphical Method: Shear and Bending Moment Diagrams	**Read:** note set 6.1 **Reference:** *note set 6.3* **Due:** Assignment 2
8.	Beam Section Properties	**Read:** Text Appendix A; note set 8 **Quiz 1**
9.	Beam Stresses	**Read:** Text 3.6-3.7; note set 9 **Due:** Assignment 3
10.	Other Beams and Pinned Frames	**Read:** Text 3.8; note sets 10.1 & 10.2 **Quiz 2**
11.	Rigid Frames - Compression & Buckling	**Read:** Text 2.8, 3.9-3.11 (not footing pressure analysis); note set 11.1 **Reference:** *note set 11.2* **Due:** Assignment 4
12.	Design Loads and Methodology	**Read:** Text 1.8-1.11; note set 12.1 **Reference:** *note sets 12.2, 12.3, 12.4 & 12.5* **Quiz 3**
13.	Wood Construction Materials & Beam Design	**Read:** Text 4.5 & 5 (all); note sets 13.1 & 13.2 **Due:** Assignment 5
14.	Column Design	**Read:** Text 6; note set 13.2 **Quiz 4**
15.	Joints and Connection Stresses	**Read:** Text 7; note sets 13.2 & 15 **Due:** Assignment 6

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

Lecture	Text Topic	Articles/ Problems
16.	Steel Construction Materials & Beam Design	**Read:** Text 4.6 & 8 (all); Text 9.1-9.8; note set 16 **Quiz 5**
17.	Trusses, Decks & Plate Girders	**Read:** Text 9.9-9.12; note sets 16 & 17 **Due:** Assignment 7
18.	Column Design	**Read:** Text 10**;** note set 16 **Quiz 6**
19.	Bolted Connections & Tension Members	**Read:** Text 11; note set 16 **Due:** Assignment 8
20.	Welds and Light Gage Steel	**Read:** Text 12; note set 16 **Quiz 7**
21.	Concrete Construction Materials & Beam Design	**Read:** Text 4.7, 13.1–13.3; note set 21.1 **Reference:** *note set 21.2* **Due:** Assignment 9
22.	T-beams & Slabs	**Read:** Text 13.4-13.5; note set 21.1 **Quiz 8**
23.	Shear, Torsion, Reinforcement & Deflection	**Read:** Text 13.6-13.8; note sets 21.1 & 23 **Due:** Assignment 10
24.	Floor Systems & Continuous Beams	**Read:** Text 14; note sets 21.1 & 24.1 **Reference:** *note sets 24.2 & 24.3* **Quiz 9**
25.	Columns & Frames	**Read:** Text 15; note set 21.1 **Due:** Assignment 11 & Project Part II
26.	Foundation Design & Footings	**Read:** Text 3.9 (footing pressure section only), Text 16; note sets 26.1 & 26.2 **Quiz 10**
27.	Masonry Construction Beams & Columns	**Read:** Text 15.4; note sets 27.1, 27.2 & 27.3 **Due:** Assignment 12
28.	Shell Systems and Synthesis	**Read:** Text 4 & 17; note sets 28.1 & 28.2 **Due:** Learning Portfolio
	Final Exam Period	**Exam**

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

DEPARTMENT OF ARCHITECTURE ARCH 614 SPRING 2013

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
JANUARY	6	7	8	9	10	11 last day to register	12
	13	14 classes begin	15 **Lect 1**	16	17 **Lect 2**	18 last day to add	19
	20	21 King Holiday	22 **Lect 3**	23	24 **Lect 4**	25	26
	27	28	29 **Lect 5** #1 due/ project	30	31 **Lect 6**	1	2
FEBRUARY	3	4	5 **Lect 7** #2 due	6	7 **Lect 8** Quiz 1	8	9
	10	11	12 **Lect 9** #3 due	13	14 **Lect 10** Quiz 2	15	16
	17	18	19 **Lect 11** #4 due	20	21 **Lect 12** Quiz 3	22	23
	24	25	26 **Lect 13** #5 due	27	28 **Lect 14** Quiz 4	1	2
MARCH	3	4 mid-term grades due	5 **Lect 15** #6 due	6	7 **Lect 16** Quiz 5	8	9
	10	11	12	13 Spring Break	14	15	16
	17	18	19 **Lect 17** #7 due	20	21 **Lect 18** Quiz 6	22	23
	24	25	26 **Lect 19** #8 due	27	28 **Lect 20** Quiz 7	29 Reading Day	30
	31	1	2 **Lect 21** #9 due last day to Q-drop	3	4 **Lect 22** Quiz 8	5	6
APRIL	7	8	9 **Lect 23** #10 due	10	11 **Lect 24** Quiz 9 pre-registration begins	12	13
	14	15	16 **Lect 25** #11 due & project	17	18 **Lect 26** Quiz 10	19	20 Muster
	21 Muster	22	23 **Lect 27** #12 due	24	25 **Lect 28** portfolio due	26	27
	28	29 (dead day) Monday classes	30 (dead day) Friday classes	1 Reading Days	2	3 Final exams	4
MAY	5	6 1-3pm 614 FINAL	7	8	9	10 Commencement (and Saturday)	11
	12	13 Grades due	14	15	16	17	18
	19	20	21	22	23	24	25