USC School of Architecture

ARCH 213A, Fall 2019
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Office hours

COURSE DESCRIPTION

A. GENERAL

1.	Course:	Architecture 213a, 3 units, Harris 101
2.	Title:	Building structures and seismic design
3.	Class meetings:	Two 1-1/2 hour lectures/workshop plus one 1-hour lab per week
4.	Examinations:	Midterm, Quizzes, and Final
5.	Time required:	9 hours per week, including class time

B. OBJECTIVES

To develop informed intuition for structures by emphasizing underlying concepts and synergy of form and structure to encourage creative design integration. To convey material sufficiently rigorous for effective communication with engineers, and analyzing of basic structures

C. SUBJECT MATTER

Historic evolution of structures, the influence of cultural, economic, and resource factors
The four S's for required for architectural structures: **S**ynergy, **S**trength, **S**tiffness and **S**tability. Study of existing structures: synergy and load paths. Load on buildings: dead- and live load; static, dynamic and thermal loads; structural responses to loads. Static equilibrium as basis of analysis; strength of materials and mechanics; stress, strain, and stress-strain relations. Numeric and graphic analysis of statically determinate beams and columns, and computer analysis of statically indeterminate beams and frames. Lateral force design.

D. STUDENT ASSIGNMENTS

Students are expected to parallel lectures with related readings, experiments, homework assignments, lab sessions, and term projects.
Handouts and homework are posted on the web http://uscarch.com/structures/ **bring handouts to class**

E. TEACHING METHODS

Lectures are augmented by lab sessions and reinforced by visual presentations and demonstration models. The material is consecutive; thus no lectures should be missed

F. BASIS FOR COURSE GRADE

Subject	Points	Percentage of grade	Grade scale
Homework	80	20%	A = 90 -100%
Term Project	80	20%	B = 80 - 89%
Quizzes & Exercises	40	10%	C = 70 - 79%
Midterm Exam	100	25%	D = 60 - 69%
Final Exam	100	25%	
Total	400	100%	

A passing grade requires to miss not more than two classes without valid written excuse.

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* Section 11, *Behavior Violating University Standards.* Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/. Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report incident to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety*. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men https://engemannshc.usc.edu/rsvp/* provides 24/7 confidential support, and the sexual assault resource center webpage https://sarc.usc.edu/ describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs (306 Watt Way, 213-740-0776)* provides certification for students with disabilities and helps to arrange relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency*

Information http://emergency.usc.edu/ will provide safety updates, including means how to provide information by means of blackboard, teleconferencing, or any other technology.

G. READING LIST

Required reading: Schierle (2008) *Structure and Design,* Cognella

Recommended reading

IBC https://www.techstreet.com/standards/icc-ibc-2018?product_id=1999609

ASCE 7 https://www.asce.org/asce-7/

H. COURSE OUTLINE

August		
Tu 27	Evolution of Structures and introduction to course objectives	Read chapter 1
Th 29	Loads: dead load (DL), live load (LL), static, dynamic, impact, and thermal loads	Read chapter 2
September		
Tu 03	Structure material: wood, steel, concrete, masonry, fabric; energy use and rupture length	Review chapters 20-24
Th 05	Structure system overview: vertical/lateral systems: wall, cantilever, moment frame, braced frame;	Read pages 187-188
	horizontal one-way and two-way systems: truss, arch, vault, dome, shell, cable stayed, suspended, membrane	Read chapter 10
Tu 10	Tributary load and load path (slab, beam, girder) and vertical members (post, wall, footing); load path;	Read pages 35-40
	Design for 4 S: Synergy, Strength, Stiffness, and Stability	Read page 42
Th 12	Forces vs. stress: tension, compression, shear, bending, torsion; symbols and notations; force and stress	Read pages 77-78
Tu 17	Stress/strain relations (Hooke's Law): Modulus of Elasticity, linear and non-linear materials, elastic, plastic, and elastic-plastic materials; Poisson's Ratio	Read pages 85-88
Th 19	Thermal stress and strain: effect on building structures and architectural systems and elements; expansion joints to prevent thermal stress	Read pages 89-92
Tu 24	Graphic vector analysis: parallelogram, force polygon, resultant, equilibrant, components; numeric method	Read pages 67-75
Th 26	Graphic truss analysis by graphic vector method: Maxwell diagrams (Bow's Notation)	Read pages 69-70
October		
Tu 01	Force and moment: static equilibrium; external reactions to load; free-body diagrams	Read pages 56-63
Th 03	Geometric properties: Centroid; Moment of Inertia for irregular sections by *Parallel Axis Theorem*	Read Appendix B
Tu 08	Determinacy for beams, trusses, and frames; implications for computation and structural performance	Read pages 64-66
Th 10	Bending and shear: method of balancing moments and free-body diagrams	Read pages 99-107
Tu 15	Area method for shear and bending	Read pages 106-107
Th 17	Fall Recess	
Tu 22	Flexure formula: Moment of Inertia, Section Modulus	Read page 109-116
Th 24	Review for midterm	
Tu 29	Shear stress in beams, general formula; shear stress an wood and steel beams	Read pages 111-116
Th 31	Midterm Exam	
November		
Tu 05	Deflection: area-moment method and standard formulas	Read pages 117-122
Th 07	Indeterminate beams: fixed-end and continuous beams	Read page 108
Tu 12	Buckling: Euler formula; "Kern" and rule of inner third; design and analysis of wood columns	Read pages 123-133
Th 14	Steel Buckling: axial stress and combined axial and bending stress	Read pages 134-140
Tu 19	Beam review	Read pages 99-107
Th 21	Term project review, 2 - 4:30 pm	
Tu 26	Seismic failure, LDG: Lateral Design Graph	Read page 367, LDG
Th 28	Thanksgiving recess	
December		
Tu 03	Review for Final Exam	
Th 12	Final Exam 2:00 to 4:00 pm in Harris 101	