A. GENERAL
1. Course: Architecture 213a, 3 units, Harris 101
2. Title: Structure systems 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: Synergy, Strength, Stiffness and Stability. 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/](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

<table>
<thead>
<tr>
<th>Subject</th>
<th>Points</th>
<th>Percentage of grade</th>
<th>Grade scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>80</td>
<td>20%</td>
<td>A = 90 -100%</td>
</tr>
<tr>
<td>Term Project</td>
<td>80</td>
<td>20%</td>
<td>B = 80 - 89%</td>
</tr>
<tr>
<td>Quizzes &amp; Exercises</td>
<td>40</td>
<td>10%</td>
<td>C = 70 - 79%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>100</td>
<td>25%</td>
<td>D = 60 - 69%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>25%</td>
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<tr>
<td>Total</td>
<td>400</td>
<td>100%</td>
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</tbody>
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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/](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/](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/](https://engemannshc.usc.edu/rsvp/) provides 24/7 confidential support, and the sexual assault resource center webpage [https://sarc.usc.edu/](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](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/](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
Recommended reading

H. COURSE OUTLINE
August
Tu 22  Evolution of Structures and introduction to course objectives
Th 24  Loads: dead load (DL), live load (LL), static, dynamic, impact, and thermal loads
Tu 29  Structure material: wood, steel, concrete, masonry, fabric; energy use and rupture length
Th 31  Structure system overview: vertical/lateral systems: wall, cantilever, moment frame, braced frame; horizontal one-way and two-way systems: truss, arch, vault, dome, shell, cable stayed, suspended, membrane

September
Tu 05  Tributary load and load path (slab, beam, girder) and vertical members (post, wall, footing); load path; Design for 4 S: Synergy, Strength, Stiffness, and Stability
Th 07  Forces vs. stress: tension, compression, shear, bending, torsion; symbols and notations; force and stress
Tu 12  Stress/strain relations (Hooke’s Law): Modulus of Elasticity, linear and non-linear materials, elastic, plastic, and elastic-plastic materials; Poisson’s Ratio
Th 14  Thermal stress and strain: effect on building structures and architectural systems and elements; expansion joints to prevent thermal stress
Tu 19  Graphic vector analysis: parallelogram, force polygon, resultant, equilibrant, components; numeric method
Th 21  Graphic truss analysis by graphic vector method: Maxwell diagrams (Bow’s Notation)
Tu 26  Force and moment: static equilibrium; external reactions to load; free-body diagrams
Th 28  Geometric properties: Centroid; Moment of Inertia for irregular sections by Parallel Axis Theorem

October
Tu 03  Determinacy for beams, trusses, and frames; implications for computation and structural performance
Th 05  Bending and shear: method of balancing moments and free-body diagrams
Tu 12  Flexure formula: Moment of Inertia, Section Modulus
Tu 17  Review for midterm
Th 19  Shear stress in beams, general formula; shear stress an wood and steel beams
Tu 24  Midterm Exam
Th 26  Deflection: area-moment method and standard formulas
Tu 31  Indeterminate beams: fixed-end and continuous beams, portals

November
Th 02  Buckling: Euler formula; “Kern” and rule of inner third; design and analysis of wood columns
Tu 07  Steel Buckling: axial stress and combined axial and bending stress
Th 09  Term project review, 2 - 4:30 pm
Tu 14  Lateral force design - LDG: Lateral Design Graph introduced
Th 16  Seismic failure
Nov 20-25 Thanksgiving recess
Tu 28  Review for Final Exam

December
Th 07  Final Exam 2:00 to 4:00 pm in Harris 101