ARCE Courses

**ARCE 106. Introduction to Building Systems. 2 units**
Term Typically Offered: F
Introduction to building systems and materials. Use and application of structural, foundation, envelope, mechanical and electrical systems in the field of Architectural Engineering. 1 lecture, 1 activity.

**ARCE 211. Structures I. 3 units**
Term Typically Offered: F,W,SP
Prerequisite: For ARCE majors: PHYS 141, MATH 142; for ARCH and CM majors: PHYS 121 or PHYS 141, MATH 142 or MATH 182.
Introduction to the role of structures in the making of buildings. Introduction to statics and creation of simple three-dimensional structures. Development of skills to analyze structures composed of axial force (truss) members. 2 lectures, 1 activity.

**ARCE 212. Structures II. 3 units**
Term Typically Offered: F,W,SP,RSU
Prerequisite: ARCE 211 (C- or better required for ARCE Majors).
Introduction to the role of structures in the making of buildings. Introduction to shear and moment diagrams using the principles of statics and the application of the diagrams to simple three-dimensional structures. Development of skills, particularly free body diagrams, to analyze structures composed of bending (beams) members. 3 lectures.

**ARCE 223. Mechanics of Structural Members. 3 units**
Term Typically Offered: F, SP
Prerequisite: ARCE 212 (C- or better required for ARCE Majors).

**ARCE 224. Mechanics of Structural Members Laboratory. 1 unit**
Term Typically Offered: F, SP
Concurrent: ARCE 223.
Experimental investigations of material properties. Experimental studies of stresses and deflections in beams, including plastic bending, and unsymmetrical bending. Stress transformations via strain gages for combined loading cases. Culminating lab experience: A student run, self-designed experiment. 1 laboratory.

**ARCE 226. Introduction to Structural Systems. 3 units**
Term Typically Offered: F,SP,RSU
Prerequisite: ARCE 212.
Description, behavior and comparison of structural building systems. Concepts of structural stability, load flow, framing schemes and building configuration related to vertical and lateral loads. Not open to Architectural Engineering majors. 3 lectures.

**ARCE 227. Structures III. 2 units**
Term Typically Offered: F,SP
Prerequisite: ARCE 212 (C- or better required for ARCE Majors).
Continuation of selected concepts covered in ARCE 211 and ARCE 212. Advanced topics in two-dimensional and three-dimensional equilibrium of structural building systems. 2 lectures.

**ARCE 257. Structural CAD for Building Design. 2 units**
Term Typically Offered: W,SP
Prerequisite: ARCH 133, CM 115.
Emphasis on the use of computer graphics software to represent a building’s structural system and its individual elements. 1 lecture, 1 laboratory.

**ARCE 260. History of Structures. 4 units**
GE Area C3
Term Typically Offered: TBD
Social, symbolic, and technical importance of landmark structures. Analysis of breakthrough ideas that led to major advances in building design. Contextualization of these advances. Tools by which to assess and critique structural art as a separate and distinct art form. 4 lectures. Fulfills GE C3.

**ARCE 270. Selected Topics. 1-4 units**
Term Typically Offered: TBD
Prerequisite: Open to undergraduate students and consent of instructor.
Directed group study of selected topics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**ARCE 302. Structural Analysis. 3 units**
Term Typically Offered: F, W
Prerequisite: ARCE 223 and ARCE 227 (C- or better required for ARCE Majors). Concurrent for ARCE majors: ARCE 352.
Analysis of statically indeterminate structures using virtual work, slope deflection, the force method and plastic analysis methods. 3 lectures.

**ARCE 303. Steel Design I. 3 units**
Term Typically Offered: W,SP
Prerequisite: ARCE 223 for ARCE majors (with C- or better); ARCE 223 and ARCE 226 for ARCE minors.
Analysis and design of steel structural members subjected to bending, shear and axial forces. 3 lectures.

**ARCE 304. Timber Design. 3 units**
Term Typically Offered: W, SP
Prerequisite: ARCE 371 for ARCE majors (with C- or better); ARCE 223 and ARCE 226 for ARCE minors.
Analysis and design of timber structural members subjected to bending, shear, and axial forces. Wood diaphragms, shear walls and their connections. 3 lectures.

**ARCE 305. Masonry Design. 2 units**
Term Typically Offered: W, SP
Prerequisite: ARCE 371 for ARCE majors (with C- or better); ARCE 223 and ARCE 226 for ARCE minors.
Design of load-bearing walls, shear walls, columns and beams in masonry. 2 lectures.
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Term Typically Offered</th>
<th>Prerequisites</th>
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<tr>
<td>ARCE 306</td>
<td>Matrix Analysis of Structures</td>
<td>3 units</td>
<td>F, W</td>
<td>ARCE 320 (C- or better required for ARCE Majors). Concurrent: ARCE 353.</td>
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<td>Analysis of statically indeterminate structures</td>
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<td>by direct stiffness method including continuous beams, plane trusses, and frames.</td>
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<td>by direct stiffness method including continuous</td>
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<td>Introduction to finite-element methods. 3 lectures.</td>
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<td>beams, plane trusses, and frames. Introduction</td>
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<td>to structures that use timber, steel and concrete as the primary construction</td>
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<td>to structures that use timber, steel and</td>
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<td>material. Introduction to gravity load carrying systems and lateral load</td>
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<td>concrete as the primary construction material.</td>
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<td>resisting systems. Introduction to tall building and long span structural</td>
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<td>Integration of structural systems into</td>
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<td>systems. Introduction to structural issues of cladding systems. Not open for</td>
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<td>architectural design. Preliminary design of</td>
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<td>major credit to Architectural Engineering majors. 4 lectures.</td>
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<td>structures including the development of gravity</td>
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ARCE 421. Soil Mechanics. 3 units
Term Typically Offered: F, W, SP
Prerequisite: ARCE 212 (C- or better required for ARCE Majors); GEOL 201.

Principles of soil mechanics, including rudiments of geology, soil classification, gravimetric and volumetric relations, compaction, methods and testing, shear strength of soil and strength theories. 2 lectures, 1 laboratory.

ARCE 422. Foundation Design. 3 units
Term Typically Offered: W, SP
Prerequisite: ARCE 421 (C- or better required for ARCE Majors).

Soil-bearing capacity, sizing and design of spread footings. Design and analysis of earth-retaining structures. Analysis of the stability of slopes. 3 lectures.

ARCE 423. Advanced Foundation Design. 3 units
Term Typically Offered: TBD
Prerequisite: ARCE 422 and ARCE 444 (C- or better required for ARCE Majors).

Design, analysis, and construction issues related to shallow and deep foundation systems, mattress foundations, retaining walls, and grade beams. Studies investigation the impact of sub-grade structural systems on building behavior and cost. 3 laboratories.

ARCE 444. Reinforced Concrete Design. 4 units
Term Typically Offered: F, W
Prerequisite: ARCE 371 and ARCE 302 (C- or better required for ARCE Majors).

Theory and design of basic reinforced concrete elements: non-slender columns, beams, tees, and one way slabs. 3 lectures, 1 laboratory.

ARCE 451. Timber and Masonry Structures Design and Constructability Laboratory. 3 units
Term Typically Offered: F, SP
Prerequisite: ARCE 257, ARCE 304, ARCE 305, and ARCE 371 (C- or better required for ARCE Majors).

Timber and masonry framed project incorporating structural system configuration and selection, structural analysis for gravity and lateral loads, and construction drawings and specifications. Integration of building services and architectural design, constructability issues, and relationships between construction methods and cost. 3 laboratories.

ARCE 452. Concrete Structures Design and Constructability Laboratory. 3 units
Term Typically Offered: W, SP
Prerequisite: ARCE 257, ARCE 444, and ARCE 372 or ARCE 451 (C- or better required for ARCE Majors).

Cast in place concrete framed project incorporating structural system configuration and selection, structural analysis for gravity and lateral loads, and construction drawings and specifications. Integration of building services and architectural design, constructability issues, and relationships between construction methods and cost. 3 laboratories.

ARCE 453. Interdisciplinary Senior Project. 1-4 units
Term Typically Offered: F, W, SP
Prerequisite: ARCE 372, ARCE 451, ARCE 452, ARCE 483 (C- or better required for ARCE Majors).

Interdisciplinary projects under faculty supervision that go beyond topics covered in the Architectural Engineering curriculum. Projects must include integration with other disciplines outside of structural or architectural engineering. Exemption of interdisciplinary requirement can be approved by department head on a case by case basis. Total credit limited to 4 units.

ARCE 460. Collaborative Design Laboratory. 2 units
Term Typically Offered: F, W, SP
Prerequisite: ARCE 372 or ARCE 451 (C- or better required for ARCE Majors).

Investigation of the collaborative nature of the design process as it relates to the architectural engineer and related disciplines Development of skills necessary to create a successful design team through the development of specific projects. Total credit limited to 4 units. 2 laboratories.

ARCE 470. Selected Advanced Topics. 1-4 units
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

ARCE 471. Selected Advanced Laboratory. 1-4 units
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

ARCE 473. Advanced Timber and Masonry Structures Laboratory. 3 units
Term Typically Offered: TBD
Prerequisite: ARCE 372, ARCE 422, ARCE 444 and ARCE 451 (C- or better required for ARCE Majors).

Emphasis on long span industrial/warehouse type buildings. Use of steel in timber/masonry construction and constructability. Holes in diaphragms, out-of-plane wall behavior and sub-diaphragms, perforated wood and masonry shear walls, pre-manufactured shear walls, masonry retaining walls, connections including post-installed anchors. 3 laboratories.

ARCE 475. Civil Infrastructure and Building Systems. 4 units
Term Typically Offered: F, W, SP
Prerequisite: Senior standing in CE or ARCE.

Principles and practices for the sustainable design, fabrication, and installation of systems for the civil infrastructure and building; including structural, air/gas, water/wastewater, electrical, and control systems. Methods and materials used for fabrication and installation; including cost and schedule considerations. 4 lectures. Crosslisted as ARCE/CE 475.
ARCE 476. Architectural Engineering Building Systems. 3 units  
Term Typically Offered: F, W, SP  
Prerequisite: Senior standing in ARCE.  

Principles and practices for the sustainable design, fabrication, and installation of architectural engineering building systems; including air/gas, water/waste water, electrical, and control systems. Methods and materials used for fabrication and installation; including cost and schedule considerations. Not open to students with credit in ARCE/CE 475.

ARCE 483. Seismic Analysis and Design. 3 units  
Term Typically Offered: F, SP  
Prerequisite: ARCE 372, ARCE 412 (C- or better required for ARCE Majors).  

Introduction to dynamic response analysis of building structures with emphasis on earthquake ground motion. Earthquake resistant design of buildings in accordance with building codes. Application of computer programs and physical models for seismic design. Laboratory studies utilizing physical models for studying the behavior of building structures subjected to simulated ground motions. 2 lectures, 1 activity.

ARCE 485. Cooperative Education Experience. 6 units  
CR/NC  
Term Typically Offered: F, W, SP  
Prerequisite: Sophomore standing and consent of department head.  

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only. Credits to not count toward graduation in the ARCE Degree Program.

ARCE 495. Cooperative Education Experience. 12 units  
CR/NC  
Term Typically Offered: F, W, SP  
Prerequisite: Sophomore standing and consent of instructor.  

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 24 units. Credit/No Credit grading only. Credits to not count toward graduation in the ARCE Degree Program.

ARCE 501. Advanced Structural Mechanics. 3 units  
Term Typically Offered: F  
Prerequisite: ARCE 306, ARCE 353.  

Principles, concepts, and techniques of advanced structural mechanics. Studies of displacement, strain, stress, strain-displacement relation and constitutive models in three dimensions. Failure criteria. Introduction into energy principles and approximate solutions. 3 lectures.

ARCE 502. Nonlinear Structural Behavior I. 3 units  
Term Typically Offered: F  
Prerequisite: ARCE 306 and ARCE 353.  


ARCE 503. Nonlinear Structural Behavior II. 3 units  
Term Typically Offered: W  
Prerequisite: ARCE 502.  


ARCE 504. Finite Element Method for Building Structures. 3 units  
Term Typically Offered: W  
Prerequisite: MATH 244, ARCE 306, ARCE 501.  


ARCE 511. Structural Systems Behavior. 3 units  
Term Typically Offered: SP  
Prerequisite: ARCE 452, ARCE 503, ARCE 504.  

Design, performance, and construction issues related to structural systems. Further development of design and analysis techniques necessary for performance based engineering of structural systems. Assessment of advantages and limitations of different structural forms and systems. 3 laboratories.

ARCE 522. Structural Systems. 3 units  
Term Typically Offered: TBD  
Prerequisite: Graduate standing in Architecture.  

Exploration of the relationship between structural systems and architectural form. Understanding of structural stability and structural order is developed through construction of a series of small scale models. Historical perspectives are presented along with the effects of available materials and technology on structural possibilities. 3 seminars.

ARCE 546. Advanced Structural Systems. 3 units  
Term Typically Offered: TBD  
Prerequisite: ARCE 371 (C- or better required for ARCE Majors) or graduate standing. Corequisite: ARCE 412 or graduate standing.  

Concepts and issues involved in the linear and non-linear design of complex structures including tall buildings, long-span structures and advanced seismic systems. 2 lectures, 1 laboratory. Formerly ARCE 446.

ARCE 548. Seismic Rehabilitation. 3 units  
Term Typically Offered: TBD  
Prerequisite: ARCE 303, ARCE 304, ARCE 305, ARCE 412, ARCE 444 (C- or better required for ARCE Majors).  

Introduction to the seismic rehabilitation process and philosophy. Evaluation and analysis of existing buildings to determine expected performance due to seismic demands. Development of basic seismic rehabilitation strategies for buildings. 2 lectures, 1 laboratory. Formerly ARCE 448.
ARCE 570. Selected Advanced Topics. 1-4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

ARCE 571. Selected Advanced Laboratory. 1-4 units
Term Typically Offered: TBD
Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

ARCE 598. Structural Engineering Design Project. 3 units
Term Typically Offered: F, W, SP
Prerequisite: Consent of instructor. Recommended: ARCE 371, ARCE 372, ARCE 452, and ARCE 483.

Independent development, research, and conclusion of a graduate project by individuals or teams specializing in the area of architectural or structural engineering. Projects may include graduate students from other disciplines. Total credit limited to 9 units.