Structural Engineering Thrust Area (2019-20)

Civil Engineering ATE (Approved Technical Elective) Advising Sheet

Each CE student is required to take 24 units of ATE (Approved Technical Electives). These electives can be any CE/ENVE 400/500 level coursework (not required as part of the major), some CE/ENVE 300 level course work, or any one of a list of preapproved elective options from outside CE/ENVE (check the department website). This freedom in the CE program allows students to specialize in a particular area (or two or three…) or develop a little deeper in all areas. Please consider your choices in the context of graduate school, the area in which you would like to practice, or the breadth of knowledge you would like to attain. Below is the ***Thrust Area*** for Structural Engineering (SE) to consider as you plan your Senior Year. **NOTE**: You may mix and match ATE's in any way you like that works best for you, your schedule and ***we encourage you to seek faculty advising*** to help map your final choices.

Students interested in Structural Engineering may wish to consider the following track. Note that there are some ***differences should the student decide to continue in pursuit of an M.S.*** either at Cal Poly or at a separate university. The courses listed in the common ATE block were the highest recommended by a local survey of structural engineering firms. Complementary courses in Construction Engineering have also been provided as these courses can offer a breath in the structural engineering area. Graduate level CE 5XX courses in structural engineering offer the opportunity to gain depth in advanced design as well as a glimpse into the level of graduate classes. However, we recommend a student consider **no more** than two graduate level courses when putting together his/her study plan. ***Courses in the SE Thrust Area require prior completion of CE352 and CE355***.

	Fall	Winter	Spring
	Choose *all* from this group:		
Common ATE core for all Structures Students	**CE 356[1] (4) - Structural Steel Design**	**CE 454 (4) - Structural Design**	
	CE 455 (4) - Design of Timber Structures		
	CE 406 (5) - Structural Analysis	**CE 415 (2) - Advanced BIM for CE**	
	CE 481 (4) -Analysis and Design of Shallow Foundations (offered Fall, Winter, and Spring)		
	Choose *at least* one of the following:		
Students Terminating with a B.S. Degree		**CE 407[3, 4] (4) - Structural Dynamics**	
		CE 553 (4) – Ductile Design of Steel Structures	**CE 552 (4) – Analysis and Seismic Design of Reinforced Concrete**
	Other options:		
Other Available Undergraduate Courses		**CE 404[2] (4) – Applied Finite Element Analysis (suggested either Winter or Spring)**	
			CE 457 (4) - Bridge Engineering
Graduate Courses[4]	**CE 556[5] (4) - FRP Strengthening of R/C Structures**	**CE 559 (4) – Prestressed Concrete Design**	**CE 557 (4) – Seismic Analysis and Design**
			CE 555 (2) - Adv. Civil Engineering Materials Lab.
Complementary Construction Engineering Courses	**CE/CM 371 (4) -Construction Management and Project Planning (offered Fall, Winter, and Spring)**		
	CE 475 (4) -Civil Infrastructure and Building Systems (offered Fall and Winter)		

1. Steel Design also offered in the Spring (however, it is a prerequisite for CE 454)
2. CE 404 is offered each quarter but requires CE 406 as a prerequisite
3. CE 406 is a required prerequisite
4. Consider waiting on these classes if continuing on with an M.S.
5. Course is very unique to Cal Poly, consider taking ***if*** continuing on with an M.S. ***NOT*** with Cal Poly

CE 356. Structural Steel Design. 4 units - Prerequisite: CE 352.
Design and behavior of the elements of steel structures. Design and analysis of bolted, welded and eccentric connections. Proportioning of members and connections. Introduction to plastic design, end plate connection, composite construction, shear connections and design of composite beams. 3 lectures, 1 laboratory.

CE 371. Construction Management and Project Planning. 4 units - Prerequisite: ARCE 106, CE 259 or CM 113.
Theory and practice of planning, scheduling, estimating, and reporting for construction projects. Fundamentals of scheduling logic including critical path, deterministic, and probabilistic scheduling; including the impact of constraints. Identifying resources and estimating time requirements for design activities and project operations. Not open to Architectural Engineering or Construction Management majors. 3 lectures, 1 activity. Crosslisted as CE/CM 371.

CE 404. Applied Finite Element Analysis. 4 units - Prerequisite: BMED 410 and CE 207; or CE 406; or ME 328.
Finite element based solutions to engineering problems with an emphasis on elastostatic problems in structural mechanics. The power and pitfalls associated with the finite element method highlighted through practical modeling assignments. Introduces the use of commercial finite element codes. 3 lectures, 1 laboratory. Crosslisted as BMED/CE/ME 404.

CE 406. Structural Analysis. 5 units - Prerequisite: CE 352.
Structural analysis of frames, trusses, and combined systems. Modern structural analysis theorems are presented along with discussion of their relation to classical methods. Specific topics include virtual forces, virtual displacements, compatibility, constraints and matrix formulations. Course may be offered in classroom-based or online format. 4 lectures, 1 laboratory.

CE 407. Structural Dynamics. 4 units - Prerequisite: CE 406 and ME 212.
Effect of vibration and transient loads on structural elements. Dynamics load factors, support motion, damping and natural frequencies of multidimensional structural systems. Modal analysis. 3 lectures, 1 laboratory.

CE 415. Advanced Building Information Modeling for Civil Engineer. 2 units - Prerequisite: CE/CM 371 and CE 355. Recomended CM 280.
Use Building Information Modeling approach to design, optimize, construct, and manage vertical structures. BIM based quantity take-off, clash detection, 4D modeling, and reality capturing using 3D laser scanner.

CE 454. Structural Design. 4 units - Prerequisite: CE 355 and CE 356.
Design of reinforced concrete, steel and timber structures. Loading standards, code design methods, connection design. Comprehensive design projects. 2 lectures, 2 laboratories.

CE 455. Design of Timber Structures. 4 units - Prerequisite: CE 355 or CE 356.
Analysis and design of timber structures with emphasis on construction methodology, and material behavior. Topics include: physical and mechanical properties of structural lumber and glued laminated timber; lateral load paths; diaphragms; connections; shear wall design; and combined load design. 3 lectures, 1 laboratory.

CE 457. Bridge Engineering. 4 units - Prerequisite: CE 355.
Fundamentals of the structural analysis and design of highway bridges. Construction materials in bridges. Loads on highway bridges. Load path and distribution in bridge superstructure. Design of reinforced concrete, pre-stressed concrete, and composite bridges. 3 lectures, 1 laboratory.

CE 481. Analysis and Design of Shallow Foundations. 4 units - Prerequisite: CE 381 and CE 382.
Evaluation of shear strength for foundation design. Analysis of bearing capacity for generalized conditions. Design of reinforced concrete spread footings. Stress distributions beneath loaded areas. Immediate settlement, consolidation settlement, rate of consolidation, and creep. 4 lectures.

CE 475. Civil Infrastructure and Building Systems. 4 units - 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.

** See catalog course descriptions for CE5xx courses. Course descriptions have not been included here for brevity.