Degrees Offered
Bachelor of Science in Civil Engineering

Educational Objectives
Through their careers, Pacific Civil Engineering graduates will:
• Plan, design, construct, maintain, analyze, advance, and manage civil engineering systems
• Pursue professional licensure and certifications
• Engage in life-long learning and pursue advanced level studies
• Demonstrate leadership skills through career advancement and active participation in the civil engineering profession and in the community

Bachelor of Science in Civil Engineering
Student must complete a minimum of 120 units of academic work and a minimum of 32 units of Cooperative Education in order to earn the bachelor of science in civil engineering degree.

I. General Education Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACS 001</td>
<td>What is a Good Society</td>
<td>4</td>
</tr>
<tr>
<td>PACS 002</td>
<td>Topical Seminar on a Good Society</td>
<td>4</td>
</tr>
<tr>
<td>PACS 003</td>
<td>What is an Ethical Life?</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: 1) Pacific Seminars cannot be taken for Pass/No Credit. 2) Transfer students with 28 or more transfer units complete 2 additional General Education elective courses from below in place of taking PACS 001 and PACS 002.

One course from each subdivision below:

Social and Behavioral Sciences
Two courses from the following:
IA. Individual and Interpersonal Behavior
IB. U.S. Studies
IC. Global Studies

Arts and Humanities
IIB. ENGR 030

One course from the following categories:
IIA. Language and Literature
IIC. Visual and Performing Arts

Note: 1) Only one course can come from each subcategory (A, B, or C) within each category. 2) No more than 2 courses from a single department may be applied to meet the breadth program requirements, with the exception of certain 1-unit GE IIC courses.

II. Diversity Requirement
Students must complete one diversity course (3-4 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 030</td>
<td>Engineering Ethics and Society</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: 1) Transfer students with 28 units or more transfer units prior to fall 2011 are encouraged but not required to complete a designated diversity course prior to graduation. 2) Courses may be used also to meet general education and/or major/minor requirements.

III. Fundamental Skills
Students must demonstrate competence in:

Writing
Quantitative analysis

Note: 1) Fundamental skills must be satisfied prior to enrolling in upper division courses.

IV. Major Requirements
Mathematics and Science (minimum 30 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 024</td>
<td>Fundamentals of Chem</td>
<td>4</td>
</tr>
<tr>
<td>MATH 051</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 053</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 055</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 057</td>
<td>Applied Differential Equations I: ODEs</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 053</td>
<td>Principles of Physics I</td>
<td>5</td>
</tr>
<tr>
<td>Math or Science Elective</td>
<td>3-4</td>
<td></td>
</tr>
</tbody>
</table>

Geological or Biological Science Elective | 3-4 |

Engineering Science:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 010</td>
<td>Dean's Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 019</td>
<td>Computer Applications in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 020</td>
<td>Engineering Mechanics I (Statics)</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 025</td>
<td>Professional Practice Seminar</td>
<td>1</td>
</tr>
<tr>
<td>ENGR 045</td>
<td>Materials Science- Properties and Measurements</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 120</td>
<td>Engineering Mechanics II (Dynamics)</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 121</td>
<td>Mechanics of Materials</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECPE 041</td>
<td>Circuits</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 122</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
</tbody>
</table>

Professional Practice (minimum 32 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 181</td>
<td>Professional Practice</td>
<td>1-18</td>
</tr>
<tr>
<td>ENGR 182</td>
<td>Professional Practice</td>
<td>1-18</td>
</tr>
<tr>
<td>ENGR 183</td>
<td>Professional Practice</td>
<td>1-18</td>
</tr>
</tbody>
</table>

Civil Engineering Core:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVL 015</td>
<td>Civil Engineering Graphics</td>
<td>3</td>
</tr>
<tr>
<td>CIVL 060</td>
<td>Water Quality</td>
<td>4</td>
</tr>
<tr>
<td>CIVL 100</td>
<td>Introduction to Structural Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CIVL 130</td>
<td>Fluid Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>CIVL 130L</td>
<td>Fluid Mechanics I Lab</td>
<td>1</td>
</tr>
<tr>
<td>CIVL 132</td>
<td>Introduction to Environmental Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CIVL 133</td>
<td>Water Resources Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CIVL 140</td>
<td>Introduction to Geotechnical Engineer</td>
<td>4</td>
</tr>
<tr>
<td>CIVL 180</td>
<td>Engineering Synthesis</td>
<td>4</td>
</tr>
<tr>
<td>EMGT 170</td>
<td>Project Decision Making</td>
<td>4</td>
</tr>
</tbody>
</table>

Select four of the following from a and b:

a. Civil Engineering Analysis Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVL 022</td>
<td>Geomatics</td>
<td>1</td>
</tr>
</tbody>
</table>

University of the Pacific 1
CIVL 134  Groundwater  
CIVL 145  Engineering Geology  
CIVL 160  Structural Analysis  
CIVL 171  Water and Environmental Policy  
CIVL 173  Sustainable Engineering  
CIVL 191  Independent Study  
CIVL 193  Special Topics  
CIVL 197  Undergraduate Research  
EMGT 174  Engineering Project Management  
b. Civil Engineering Design Electives:  
CIVL 136  Design of Water Quality Control Facilities  
CIVL 138  Solid Waste Systems Design and Management  
CIVL 141  Earth Structure Design  
CIVL 150  Transportation Engineering  
CIVL 151  Heavy Construction Methods  
CIVL 165  Structural Steel Design  
CIVL 166  Reinforced Concrete Design  
CIVL 193  Special Topics  

**Note:** A minimum of 2 design electives (6 units) must be taken, of which 1 course will include a 3 or 4 unit structural design elective and 1 course must be a 3 or 4 unit non-structural design elective.

### Department of Civil Engineering Faculty

**Gary M. Litton,** Professor and Associate Dean of the School of Engineering and Computer Science, 1993, BS, University of California, Irvine, 1980; MS, 1990; PhD, 1993. Registered Professional Engineer. Environmental engineering, water quality and modeling.

**Camilla M. Saviz,** Chair and Professor of Civil Engineering, 1999, BSME, Clarkson University, 1987; MSME, 1989; MBA, New York Institute of Technology, 1991; PhD, Civil and Environmental Engineering, University of California, Davis, 2003. Registered Professional Engineer. Environmental engineering, water resources, hydrodynamic and water quality modeling, fluid mechanics.


**Mary Kay Camarillo,** Associate Professor of Civil Engineering, 2009, BS, University of Washington, 1996; MS, University of California, Davis, 2004; PhD, 2009; Registered Professional Engineer. Environmental engineering, physical and chemical treatment of water and wastewater.

**Hector Estrada,** Professor of Civil Engineering, 2006, BS, University of Illinois, 1993; MS, 1994; PhD, 1997. Registered Professional Engineer. Structural engineering and engineering mechanics.


**Luke Lee,** Associate Professor of Civil Engineering, 2008, BS, University of California, Los Angeles, 1997; MS, University of California, Berkeley, 1998; PhD, University of California, San Diego, 2005; Registered Professional Engineer. Structural engineering and rehabilitation and monitoring of infrastructure systems.

**Scott M. Merry,** Professor of Civil Engineering, 2010, BS, University of Arizona, 1991; MS, Purdue University, 1993; PhD University of CA, Berkeley, 1995; Registered Professional Civil and Geotechnical Engineer; Geotechnical engineering, levees and slope stability; engineering management.

**William Stringfellow,** Professor and Dir. of the Ecological Engineering Research Program, 2009, BS Environmental Health, University of Georgia, 1980; MS Microbiology, Virginia Polytechnic Institute, 1984; PhD Environmental Sciences and Engineering, University of North Carolina, 1994.

**Dr. Henghu (Henry) Sun,** Professor and Dir., Pacific Resources Research Center, 2008, 2008 Professor, PCSP Program, TJL Pharmacy School, University of the Pacific; 2002-2008, Professor, Tsinghua University, 1988, PhD China University of Mining and Technology.

### Civil Engineering Courses

**CIVL 015. Civil Engineering Graphics. 3 Units.**  
Coverage of the principles and applications of graphics in engineering design. Pictorial and isometric sketching and orthographic projection and use of auxiliary views and sections are used. Drafting standards and conventions, dimensioning and tolerances. Layout and assembly drawings, detail drawings and production drawings using AutoCAD software. Laboratory work is included. Prerequisite may be taken concurrently: ENGR 010 with a "C-" or better.

**CIVL 022. Geomatics. 3 Units.**  
This course is an introduction to geomatics engineering which includes in depth coverage of plane surveying and an introduction to Global Navigation Satellite Systems (GNSS), geodetic and geospatial sciences. Fundamental surveying methods and equipment will be presented in both a lecture and a hands-on laboratory section. Topics include: error theory, leveling, traverse computations, topography, coordinate systems, construction surveying, geometric design, Global Navigation Satellite Systems (GNSS), photogrammetry and the presentation of other emerging and relevant technologies. Prerequisite: MATH 041 with a "C-" or better or a passing score on the University's trigonometry placement test.

**CIVL 060. Water Quality. 4 Units.**  
Students examine chemical reactions and processes in aquatic systems with engineering applications. Topics include chemical equilibrium and kinetics associated with acid-base, dissolution-precipitation, complexation, and reduction-oxidation reactions in natural and engineered environments. Laboratory work is included. Prerequisites: CHEM 024 or CHEM 025 or CHEM 027; and MATH 051 with a "C-" or better. (ENST)

**CIVL 100. Introduction to Structural Engineering. 4 Units.**  
Introduction to the theory and applications of structural analysis and design. Topic include: determination of loads, analysis of beams, trusses and frames, influence line and indeterminate structures. Prerequisites: Completion of all Fundamental Skills, ENGR 019, ENGR 121 with a "C-" or better. (ENST)

**CIVL 130. Fluid Mechanics I. 3 Units.**  
Students study the physical properties of fluids, statics and dynamics of incompressible fluids that include hydrostatics, conservation of mass, energy and momentum principles, laminar and turbulent flow with emphasis on pipe flow. Prerequisite: Completion of all Fundamental Skills and ENGR 120 with a "C-" or better. Corequisite: CIVL 130L.
CIVL 130L. Fluid Mechanics I Lab. 1 Unit.
Experimental analysis of concepts are discussed in CIVL 130. Prerequisite: Completion of all Fundamental Skills and ENGR 120 with a "C-" or better. Corequisite: CIVL 130.

CIVL 132. Introduction to Environmental Engineering. 4 Units.
Students are introduced to the physical, chemical, and biological processes associated with water quality in natural environments and engineering systems. Topics include operation and design of wastewater treatment facilities as well as the occurrence, behavior and control of indoor and regional air pollution. Laboratory is included. Prerequisites: Completion of all Fundamental Skills, CIVL 015, CIVL 060 with a "C-" or better.

CIVL 133. Water Resources Engineering. 4 Units.
Students examine hydraulic analysis and design that include pipe flow and open channel flow. Topics include elements of the hydrological cycle, deterministic and probabilistic analysis of rainfall-runoff data for estimation and design, and the application of computers in hydrologic and hydraulic design. Laboratory is included. Prerequisites: Completion of all Fundamental Skills, CIVL 015, CIVL 130 with a "C-" or better.

CIVL 134. Groundwater. 4 Units.
Students study groundwater hydraulics in confined and unconfined aquifers. Topics include the processes controlling that control the transport and fate of minerals and contaminants in subsurface environments, computer simulation of groundwater flow and contaminant movement, and strategies for removing and controlling contaminant plumes in aquifers. Prerequisites: Completion of all Fundamental Skills; CIVL 061, CIVL 130; MATH 057 all with a "C-" or better.

CIVL 136. Design of Water Quality Control Facilities. 4 Units.
This advanced course covers the physical, chemical, and biological processes that are involved in the design of water and wastewater treatment plant facilities as well as applicable design standards and regulations. Prerequisites: Completion of all Fundamental Skills, CIVL 130, CIVL 132 with a "C-" or better.

CIVL 138. Solid Waste Systems Design and Management. 3 Units.
This is an introductory course to solid waste systems, that analyzes problems associated with storage, collection, transport, processing, and disposal of solid wastes. Students review of current and expected regulatory requirements and the planning and design of solid waste management components that include systems and processes for solid waste prevention, recycling/composting, incineration, and landfilling. Prerequisite: Completion of all Fundamental Skills and CIVL 132 with a "C-" or better.

CIVL 140. Introduction to Geotechnical Engineering. 4 Units.
This introductory course covers the fundamentals of geotechnical engineering, that includes the characterization of soils and their behavior as an engineering material. Topics, include classification of soils, compaction, permeability, and consolidation. Also covered is design applications that include settlement predictions, strength characterization, soil exploration programs, and an overview of shallow and deep foundations. The course includes laboratory work. Prerequisites: Completion of all Fundamental Skills, CIVL 015, ENGR 121 with a "C-" or better.

CIVL 141. Earth Structure Design. 4 Units.
Evaluation of drained and undrained field conditions and the relationship between temporary and permanent design conditions over time. In-situ tests, including SPT and CPT. Analysis of lateral stresses in soil masses. Design of slopes, cantilever retaining walls, sheet piles, anchored bulkheads, and mechanically-stabilized earth walls. Design includes analysis of effects of water and seismic conditions, including liquefaction. Prerequisite: CIVL 140.

CIVL 145. Engineering Geology. 4 Units.
This introductory course to geology in which geologic principles, data and techniques are applied to civil engineering problems. Also listed as GEOS 145. Prerequisites: Completion of all Fundamental Skills; GEOS 051 or GEOS 061 or CIVL 140 with a "C-" or better.

CIVL 150. Transportation Engineering. 4 Units.
Students study the considerations and procedures in the planning, design, and operation of various transportation systems with primary emphasis on highways. Prerequisites: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 151. Heavy Construction Methods. 4 Units.
An introduction to the areas of construction engineering and construction management. Construction engineering topics include construction processes and construction econometrics. Construction management topics include contracting, estimating, planning, bidding, and scheduling. Prerequisite: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 160. Structural Analysis. 3 Units.
Students analyze the behavior of trusses and framed structures under gravity and lateral loads. Other topics include analysis of shear walls, the use of structural analysis software, and the buckling of frames. Prerequisites: Completion of all Fundamental Skills; CIVL 100 and MATH 057 with a "C-" or better.

CIVL 164. Structural Timber Design. 4 Units.
Students will study the design of timber structural members, specifically tension, compression, flexural, and beam-column elements and connections to satisfy design code requirements. Prerequisite, may be taken concurrently: CIVL 100.

CIVL 165. Structural Steel Design. 4 Units.
Students study the design of steel structural members, specifically tension, compression, flexural, and beam-column elements and connections to satisfy design code requirements. Prerequisite: Completion of all Fundamental Skills. Prerequisite may be taken concurrently: CIVL 100 with a "C-" or better.

CIVL 166. Reinforced Concrete Design. 4 Units.
Students study the design and proportioning of structural members, specifically beams, columns, one-way slabs, footings, and walls to satisfy design criteria for reinforced concrete systems. Prerequisite: Completion of all Fundamental Skills. Prerequisite may be taken concurrently: CIVL 100 with a "C-" or better.

CIVL 171. Water and Environmental Policy. 3 Units.
This course introduces students to Federal and State of California environmental regulations pertaining to air, water, hazardous wastes, and toxic substances. Topics include an overview of water rights and environmental impact assessment, relevant case studies, and examples of monitoring and enforcement issues. Prerequisite: Completion of all Fundamental Skills. Junior or Senior standing. (ENST)
CIVL 173. Sustainable Engineering. 3 Units.
This interdisciplinary course provides an introduction to principles and practice of sustainable engineering. Topics include the analysis of economic, social, and environmental factors, life cycle assessment, resource use and waste generation in engineering products and processes. The course also examines case studies, readings, and class discussion emphasizes analysis and development of sustainable solutions. Prerequisite: Completion of all Fundamental Skills. Junior or Senior standing.

CIVL 180. Engineering Synthesis. 4 Units.
This course is a culminating experience wherein a group of students synthesize their previous class work into one project. Both technical and non-technical concerns are addressed. One or more faculty members and/or professional engineers are involved depending upon the fields covered in the project. Prerequisites: Completion of all Fundamental Skills; EMGT 170 and 2 of the following: CIVL 100, CIVL 132, CIVL 133, CIVL 140 with a "C-" or better. Senior standing.

CIVL 191. Independent Study. 1-4 Units.
Students undertake special individual projects under the direction of one or more faculty members. Permission of department chairperson and faculty member involved.

CIVL 193. Special Topics. 4 Units.
Upper division elective subject area based on expertise of faculty members.

CIVL 197. Undergraduate Research. 1-4 Units.
This course is applied or basic research in civil engineering under faculty supervision. Permission of faculty supervisor and department chair. Student must be in good academic standing.