ABET Program Self-Study Report
June 25, 2017

Degree of Bachelor of Science in Civil Engineering

Submitted by
School of Engineering
San Francisco State University
1600 Holloway Avenue, SCI 163
San Francisco, CA 94132

Submitted to
Engineering Accreditation Commission
The Accreditation Board for Engineering and Technology
111 Market Place, Suite 1050
Baltimore, Maryland 21202-4012
CONFIDENTIAL

The information supplied in this Self-Study Report is for the confidential use of ABET and its authorized agents, and shall not be disclosed without authorization of the institution concerned, except for summary data not identifiable to a specific institution.
Signature Attesting to Compliance

By signing below, I attest to the following:

That the Civil Engineering program of the School of Engineering at San Francisco State University has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's Criteria for Accrediting Engineering Programs to include the General Criteria and any applicable Program Criteria, and the ABET Accreditation Policy and Procedure Manual

Keith J. Bowman  
Dean's Name (As indicated on the RFE)  

15 June 2017  
Date
# Table of Contents

Background information .................................................................................. 5
Criterion 1. Students ....................................................................................... 10
Criterion 2. Program Educational Objectives ............................................. 21
Criterion 3. Student Outcomes ..................................................................... 28
Criterion 4. Continuous Improvement .......................................................... 32
Criterion 5. Curriculum ............................................................................... 72
Criterion 6. Faculty ..................................................................................... 91
Criterion 7. Facilities .................................................................................. 102
Criterion 8. Institutional Support ................................................................. 115
Program Criteria ......................................................................................... 130

Appendix A – Course Syllabi ....................................................................... 144
Appendix B – Faculty Vitae ......................................................................... 208
Appendix C – Equipment ........................................................................... 235
Appendix D – Institutional Summary ............................................................. 240
Appendix E – Additional Supporting Information ..................................... 246
BACKGROUND INFORMATION

A. Contact Information

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Fax: (415) 338-0525
Email: wspong@sfsu.edu

B. Program History

The degree awarded by the undergraduate program in civil engineering at San Francisco State University is Bachelor of Science in Civil Engineering (BSCE). The initial ABET accreditation for the School of Engineering occurred in 1972. The most recent accreditation visit took place in 2011.

New Faculty

The School of Engineering has hired two new faculty members in Civil Engineering since the last accreditation:

- Prof. Zhoashuo Jiang was hired in Fall 2014 after a national search for faculty in the area of Civil Engineering with the focus on structural engineering. Prof. Jiang graduated from the University of Connecticut in 2012 with a Ph.D. degree in Civil Engineering. Before joining San Francisco State University as an assistant professor, he worked for Skidmore, Owings & Merrill (SOM) LLP, one of the largest and most influential architectural and engineering firms worldwide. As a licensed professional engineer in the states of Connecticut and California, Dr. Jiang has been involved in the design of a variety of low-rise and high-rise projects, including office towers, retails, hotels, courthouses, and theatre according to the U.S. and international building codes. This experience brings unique design aspects to the classroom, which is very valuable for applied science areas
such as Engineering. Prof. Jiang’s current research focuses on smart structure technologies including structural control, health monitoring and advanced sensing as well as using new emerging technologies for innovative engineering education. He teaches both undergraduate and graduate courses such as ENGR 309 (Mechanics of Solids; Undergraduate; Required course for both Civil Engineering and Mechanical Engineering), ENGR 425 (Reinforced Concrete Structures; Undergraduate; Required course for Civil Engineering), ENGR 829 (Advanced Topics in Structural Engineering; Graduate; Elective course for Civil Engineering), ENGR 831 (Advanced Reinforced Concrete Structures; Graduate; Elective course for Civil Engineering), and ENGR 838 (Smart Structures Technology; Graduate; Elective course for Civil Engineering).

- Professor Jenna Wong was hired in Spring 2016 after a national search for faculty in Civil Engineering. Professor Wong received her Ph.D. in Structural Engineering in 2014 from the University of California, Berkeley, where she was a graduate research assistant in the area of seismic isolation for nuclear facilities. While completing her dissertation, in Fall 2014, she joined San Francisco State University as a lecturer. She additionally worked in industry with URS/AECOM achieving her Professional Engineer’s license in December 2014. After receiving her Ph.D., she worked as a post-doctoral fellow at the Lawrence Berkeley National Laboratory. She began her service as Assistant Professor in the School of Engineering’s Civil Engineering program in Fall 2016. Professor Wong’s research focuses on seismic isolation and performance based design. Her current research focuses on investigating the influence of isolation properties on structural response, the effectiveness of code standards, and soil structure interaction. She teaches courses such as ENGR 100 (Introduction to Engineering), 102 (Statics), 426 (Steel Design), 461 (Mechanical and Structural Vibrations), and 800 (Engineering Communications).
New Grants

The table below summarizes new grants.

<table>
<thead>
<tr>
<th>Grant</th>
<th>Faculty</th>
<th>Amount</th>
<th>Years</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF-BRIGE Grant</td>
<td>Cheng Chen</td>
<td>$171,825</td>
<td>2012-2015</td>
<td>BRIGE: Reliability Assessment</td>
</tr>
<tr>
<td>NSF-MRI Grant</td>
<td>Cheng Chen</td>
<td>$246,454</td>
<td>2011-2014</td>
<td>MRI: Hydraulic structure test system</td>
</tr>
<tr>
<td>Small Grant Award, ORSP, SFSU</td>
<td>Cheng Chen</td>
<td>$14,796</td>
<td>2014-2015</td>
<td></td>
</tr>
<tr>
<td>Small Grant Award, ORSP, SFSU</td>
<td>Cheng Chen</td>
<td>$8,500</td>
<td>2013-2014</td>
<td></td>
</tr>
<tr>
<td>Wang Family Faculty Award, CSU</td>
<td>Cheng Chen</td>
<td>$10,000</td>
<td>2012-2013</td>
<td></td>
</tr>
<tr>
<td>NSF-satem</td>
<td>Wenshen Pong</td>
<td>$600,000</td>
<td>2009-2013</td>
<td></td>
</tr>
<tr>
<td>U.S. DOE Minority STEM</td>
<td>Wenshen Pong</td>
<td>$183,000</td>
<td>10/2015-09/2018</td>
<td></td>
</tr>
<tr>
<td>U.S. DOE HIS-STEM</td>
<td>Wenshen Pong</td>
<td>$750,000</td>
<td>2011-2016</td>
<td></td>
</tr>
<tr>
<td>NASA-CiPair</td>
<td>Wenshen Pong</td>
<td>$145,000</td>
<td>2010-2013</td>
<td></td>
</tr>
<tr>
<td>IDEA Impact Center</td>
<td>Zhaoshuo Jiang</td>
<td>$9,400</td>
<td>07/2017-07/2018</td>
<td>Mobile Laboratory Teaching</td>
</tr>
<tr>
<td>Quanser Inc</td>
<td>Zhaoshuo Jiang</td>
<td>$129,000</td>
<td>2016-2019</td>
<td>Mobile Interactive Shake Table Lab</td>
</tr>
<tr>
<td>SFSU ORSP</td>
<td>Zhaoshuo Jiang</td>
<td>$12,500</td>
<td>2016-2017</td>
<td>High-rise Building Design</td>
</tr>
<tr>
<td>Kern Family Foundation</td>
<td>Zhaoshuo Jiang</td>
<td>$2,750</td>
<td>2016-2017</td>
<td>e-Learning Modules</td>
</tr>
<tr>
<td>CSU Chancellor’s Office</td>
<td>Zhaoshuo Jiang</td>
<td>$17,966</td>
<td>2016-2017</td>
<td>Virtual Labs</td>
</tr>
</tbody>
</table>

C. Options

(not applicable)
The School of Engineering consists of four programs, offering degrees in Civil Engineering, Computer Engineering, Electrical Engineering and Mechanical Engineering. There are no options, tracks or concentrations included in the Civil Engineering degree program. The degree is a B.S. in Civil Engineering.

The organizational structure of the unit is as follows:
President: Les Wong
Provost and Vice President for Academic Affairs: Jennifer Summit
Dean of College of Science and Engineering: Keith J. Bowman
Director of School of Engineering: Wenshen Pong
Program Head of Civil Engineering: Tim D’Orazio

Details of the organization and the responsibilities of the leadership are given in Criterion 8.

D. Program Delivery Modes

The program in civil engineering is primarily offered as an on-campus day program, although some courses and labs are also offered in the evening during the weekdays. The dominant mode of instruction is the traditional lecture/laboratory format. However, some professors have recently been using distance and collaborative solutions in conjunction with their in-class lectures to allow registered student to participate in class from off-campus. Many professors also use iLearn, an online teaching/learning management system, to supplement classroom instruction, and manage distribution of course material and collection of assignments.

E. Program Locations

All portions of the program are located on the main campus of the University:
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

F. Public Disclosure

The Program Educational Objectives (PEOs) and Student Outcomes (SOs) are available to the public at http://engineering.sfsu/mission_and_objectives/civil.html and http://engineering.sfsu.edu/academics/undergraduate/major/civil/overview_and_description.html, respectively. The annual student enrollment and graduation data is available to the public at http://engineering.sfsu.edu/academics/undergraduate/major/civil/overview_and_description.html
G. Deficiencies, Weaknesses or Concerns remaining from Previous Evaluation(s) and the Actions Taken to Address Them

(not applicable)
CRITERION 1. STUDENTS

This chapter describes who our students are and how they are admitted, evaluated, advised and monitored throughout their progress in the Civil Engineering program at San Francisco State University.

The current enrollment in the School of Engineering is around 1500 undergraduate students and approximately 100 graduate students. Approximately 325 of the undergraduates are in the Civil Engineering Program. The student body is ethnically, culturally, academically, and economically diverse. About 16% of the School’s students are women and 65% are ethnic minority (39.0% Asian, 21.0% Hispanic, and 5.0% Black). Many of our students are the first ones in their families to attend college. Most of them have to work to support themselves through college and attend the School part time. Also, lower division students take classes that are not offered by the School of Engineering, e.g. Math 226, Physics 220/222, and Chemistry 180. Thus, a 1500-student body yields about 475.5 full time equivalent students (FTES) in the School of Engineering. The distribution of FTES among Civil, Computer, Electrical, and Mechanical Engineering is approximately 23.8%, 22.1%, 18.2%, and 35.8%, respectively. The average SAT Critical Reading (Verbal), Math and Writing Scores of our 2016-17 incoming engineering freshmen class are, 470, 510 and 455, respectively.

Our students are highly motivated and focused on acquiring knowledge necessary for a successful engineering career. For financial reasons, as mentioned above, most of our students work part-time; a few even work full-time. On the one hand, this work experience contributes greatly to their motivation; on the other hand, it also means that many of them may not have the time to perform academically to their full potential. As a consequence, the average GPA for the upper division students of the Civil Engineering Program was 2.86 in the fall of 2016. The need to hold a part-time job also lengthens the time in school for many students. The School graduated 129 undergraduate students in year 2015, 55 of them in the CE Program. Most of our graduates find jobs in the Bay Area. Approximately 10% of our graduates pursue advanced degrees in the School of Engineering or at other institutions such as UC Berkeley, Davis, or Stanford. (Additional information on students can be found in Appendix D, Institutional Profile.)

A. Student Admissions

Students who apply for admission are first evaluated when they submit their application to the University. They must meet the entry requirements of the University as described in
Appendix D. If they meet the university requirements and apply to be admitted into Civil Engineering, they are accepted (our program is not impacted).

A total of 566 students applied for civil engineering as first-time freshmen of whom 379 students were admitted and 58 students were enrolled in fall 2016. A total of 193 students applied for civil engineering as new transfers and 151 students were admitted and 33 students were enrolled in Fall 2016. Table 1-1 shows the application, admission and enrollment data for the civil engineering program from 2011 to 2016.

<table>
<thead>
<tr>
<th>Year</th>
<th>First-time Freshmen</th>
<th></th>
<th></th>
<th>Transfers</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Applied</td>
<td>Admitted</td>
<td>Enrolled</td>
<td>Applied</td>
<td>Admitted</td>
<td>Enrolled</td>
</tr>
<tr>
<td>2011</td>
<td>408</td>
<td>264</td>
<td>44</td>
<td>198</td>
<td>119</td>
<td>32</td>
</tr>
<tr>
<td>2012</td>
<td>440</td>
<td>296</td>
<td>51</td>
<td>171</td>
<td>102</td>
<td>39</td>
</tr>
<tr>
<td>2013</td>
<td>530</td>
<td>344</td>
<td>53</td>
<td>211</td>
<td>115</td>
<td>35</td>
</tr>
<tr>
<td>2014</td>
<td>577</td>
<td>382</td>
<td>63</td>
<td>179</td>
<td>119</td>
<td>23</td>
</tr>
<tr>
<td>2015</td>
<td>592</td>
<td>398</td>
<td>59</td>
<td>176</td>
<td>143</td>
<td>29</td>
</tr>
<tr>
<td>2016</td>
<td>566</td>
<td>379</td>
<td>58</td>
<td>193</td>
<td>151</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 1-1: Application, admission and enrollment data 2011-2016

**B. Evaluating Student Performance**

After being evaluated for admission, the subsequent evaluation of student performance in different courses is conducted by the instructors of those courses. Students are graded on a four point basis (A=4, B=3, C=2, D=1, F=0). Each instructor is given the freedom to assign grades as he or she sees fit.

The Registrar’s Office monitors students’ GPAs for possible probationary action. One semester of work below a GPA of 2.0 triggers probationary status. Once a student is on probation, he or she needs to go through the mandatory probation advising process in order to be able to register for the next semester. Students need to fill out a probation contract, then bring a copy of the most recent transcript to a meeting with the Program Head. The CE Program Head discusses the situation with the student and recommends action (such as reduced work hours, tutoring, reduced course load, or no action if something like a family illness is the cause). A meeting with the Director of the School of Engineering is also required for such a student. The Director reviews the Program Head’s recommendations and either approves or sends the student back to the Program Head for further review. The Director of the Student Resource Center of the College of Science and Engineering also evaluates the School recommendations and discusses them with the student. A student on probation for two consecutive semesters is subject to disqualification from the university. With our students, a majority of cases of academic probation result from students having to work many hours to support themselves in their studies.
When the number of work hours is reduced, and the amount of time available for study increases, we often see a dramatic change in performance.

In order to prepare for graduation, seventh-semester students in the ENGR 696: Engineering Design Project I course, are required to fill out a mock graduation application. These applications are reviewed by the Program Head and a GE advisor to make sure that students have taken all appropriate courses by the graduation date and that all graduation requirements will be satisfied. Students are informed about any potential deficiency in either Engineering and/or GE requirements so that they can correct any deficiencies in time.

In the review for graduation, each student’s record is evaluated by the Head of the CE Program, the Director of the School, and the University Registrar to ensure that students meet all graduation requirements. The GPA required for graduation is 2.0. Students with a GPA slightly lower than 2.0 who have taken all the units and courses required for graduation are usually given one semester to take courses to boost their GPA above 2.0. They are allowed to graduate if they are successful in raising their GPA. If they fail to increase their GPA significantly enough, they are dismissed from the university.

The prerequisites of every student are checked in every upper-division course every semester by instructors. Instructors can access a University database that lists students’ grades for prerequisite courses to help them determine whether students have met the required prerequisites. The database includes courses taken by students while at SFSU as well as courses taken at community colleges that articulate to SFSU courses.

Some courses taken by transfer students do not appear in the University database and must be verified based on the mandatory evaluations that are conducted on every transfer student by the program head of Civil Engineering as part of the advising process and recorded in each student’s Student Planning Worksheet. Instructors are tasked to notify students who do not appear to have met the prerequisites by the second week of the term. Students are urged to address the prerequisite deficiency immediately and warned that if they do not, they will be administratively withdrawn from the course.

Often prerequisite deficiencies result from those transfer students whose grades do not appear on the university database but who have failed to meet with the Program Head to have their courses evaluated. In these cases, the student would go to the program head for the appropriate evaluation. The remaining students who do not have the appropriate prerequisites, but have a compelling reason for a waiver, have the option of petitioning for a waiver of the course prerequisite from the course instructor. If the instructor approves, the student and instructor complete a Prerequisite Waiver Form (Appendix E.4) that is sent to the Engineering Office. Exceptions may occasionally be made for good cause – for example, if the student concurrently enrolled in a prerequisite course that was previously taken with an insufficient grade.
We are careful about withdrawing students administratively, and do so only as a last resort, because those students who receive financial aid are required to carry a minimum number of units (usually 12). The Department of Homeland Security also has very strict rules about the minimum number of units foreign students must take. So, the School makes a special effort to make sure that students with prerequisite problems are fully apprised of their prerequisite deficiencies and have had the opportunity to come in to discuss them with us in person.

By the fourth week, the number of prerequisite-deficient students is generally much reduced, because most students have either completed the necessary transfer evaluation process, have withdrawn from the class, or have obtained a waiver. This procedure assures that all upper-division students have been properly advised regarding prerequisites and have been given a fair chance to remedy any deficiencies.

University policy permits a student to attempt any course only twice as a matriculated student. In extraordinary circumstances, students can petition the Associate Dean of the College of Science and Engineering to retake the course a third time, but under normal circumstances, after two attempts, the only real option at SFSU is to retake the course through the University’s College of Extended Learning program.

The Registrar’s Office monitors students’ GPAs for possible probationary action. Probationary status is triggered by a GPA of below 2.0 for either all college work attempted or all work at SFSU. Once a student is on probation, he or she must undergo a mandatory probation advising process in order to be able to register for the next semester. This advising procedure is described in Section D below.

Students on probation are subject to disqualification when:

- As freshmen (fewer than 30 units completed), they fall below a grade point average of 1.50 in all college units attempted or in all SF State units attempted.
- As sophomores (30 through 59 units completed), they fall below a grade point average of 1.70 in all college units attempted or in all SF State units attempted.
- As a junior (60 through 89 units completed), they fall below a grade point average of 1.85 in all college units attempted or in all SF State units attempted.
- As senior or second BA students (90 or more units completed), they fall below a grade point average of 1.95 in all college units attempted or in all SF State units attempted.

Additional probation and disqualification policies are provided in the SFSU Bulletin (http://bulletin.sfsu.edu/policies-procedures/academic-standards/).

C. Transfer Students and Transfer Courses
Students who transfer into the School of Engineering from other institutions must meet both the requirements of the University and of the School of Engineering. The University’s requirements are detailed online (http://www.sfsu.edu/future/apply/transfer.html). Due to enrollment pressures, SFSU has not accepted lower-division transfers (those who have completed fewer than 60 transferable semester units) for many years. SFSU currently does not accept second-baccalaureate students.

A significant number of our students transfer to our program from California’s community colleges. The community college system allows students to take practically the entirety of their lower-division engineering curriculum, including all the prerequisite mathematics, physics, chemistry, and computer science courses. Clearly defined and published articulation agreements exist between our university and the community colleges that cover most of the courses that are eligible for transfer. These are found on the website http://www.assist.org. Courses taken at institutions that are not part of articulation agreement, for example from accredited American colleges and universities outside the state of California, are evaluated based on course content, grade, name, number of units, and sequence in which the courses were taken at the transfer institution.

On entry into the civil engineering program, each transfer student is required to meet with the program head to evaluate and transfer all applicable courses, as well as to get advice on the appropriate course of study. Courses approved for transfer are noted on the Transfer Evaluation Form which is part of the Student Planning Worksheet issued to every student and maintained by the engineering office as part of the student’s permanent record. Transfers of articulated courses are generally straightforward, although on transfers from programs on the quarter system to SFSU (which operates on the semester system) occasionally lead to a unit deficiency, which the student must resolve during their course of study in a manner that is specified by the program head (for example, by having the student take an extra engineering elective course). It is the policy of the School of Engineering that only courses completed with a grade of C- or better can be transferred.

Transfers of upper-division courses (course number 300 or higher) are not covered by articulation agreements; however, they may be approved on a case-by-case basis upon presentation of compelling evidence of equivalency to one of our upper-division courses. The student may be required to present a course catalog description, syllabus, textbooks and class notes if applicable. The instructor of the equivalent upper-division course is often asked to review the transfer request and approve it if appropriate. Community college courses, in general, are not acceptable as upper-division transfers.

Transfers of courses from foreign institutions present special challenges. In order to transfer courses from foreign institutions, a student must first obtain a Degree Progress Report from the University, which provides a detailed accounting of exactly how many units from which courses will be allowed for credit. The program head reviews the Degree Progress
Report in conjunction with an analysis of students’ transcripts (which are required to have an official translation, if not in English), course catalog description, syllabus, textbooks and class notes, and determines towards which science, mathematics and engineering courses transfer credit can be applied. Among the factors considered by the program head and instructors in approving transfer requests are number of units, course contents, laboratory content, and other factors.

Transferring courses is a time-consuming process which we take seriously in order to ensure fairness to all engineering students. This process has been used successfully for many years. When courses meet the standards of both the University and the School of Engineering, the program head or instructor signs his/her name on the last column of the Transfer Evaluation Form (page 4 of the Student Planning Worksheet) to indicate that those courses are officially transferred to the School of Engineering.

D. Advising and Career Guidance

The School of Engineering considers advising as an integral part of teaching and learning. Our advising program has the following five major objectives:

1. To disseminate accurate information to students regarding university and departmental policies, procedures, requirements, and resources.
2. To assist students in developing their interest in engineering, and in setting their goals and objectives.
3. To review students’ course selection and monitor their progress toward their academic goals; and, if they have academic difficulties, to assist them in taking corrective action.
4. To obtain informal feedback from students about policies, procedures, resources, and curriculum.
5. To provide students with information, guidance, and assistance in job search and advanced studies.

School of Engineering Advising Procedure

The University Advising Policy requires that students be advised at four pivotal points during their education at SFSU:

1) when a student enters the university;
2) when the student enters the major or minor program;
3) when the student experiences academic difficulty, including probation and possibility of disqualification
4) when the student prepares to graduate.

The School of Engineering goes beyond these four points by providing mandatory upper division and lower division advising, as described below.

A prospective student may obtain information about the Civil Engineering (CE) Program by visiting the School’s website (http://engineering.sfsu.edu), by talking directly with the Program Head (in person or over the telephone), and/or by requesting a brochure (Appendix III.6).

All new engineering students are sent an email strongly urging them to attend a new student Orientation/Advising meeting held just before the start of each semester. The School’s Director, engineering Lower Division (LD)/ General Education (GE) Advisors, and possibly other engineering faculty members present information about our programs, proper sequence of courses, GE requirements, and graduation requirements. The special needs of upper division (UD) and lower division (LD) students are addressed in small groups with the CE Program Head and LD/GE advisors, respectively. These requirements and advice for students are also available on the School’s website (http://www.engineering.sfsu.edu/academics/index.html) At the orientation meetings, students are able to obtain immediate, informal one-on-one advice from the LD/GE advisors and CE Program Head on various issues such as selection of courses for the upcoming semester and transfer course evaluation.

At the Orientation meeting and on Advising Week day, transfer students are advised to make an appointment with the appropriate Program Head in order to have their transferred courses evaluated for satisfaction of engineering requirements. The students are urged in repeated emails to get their transfer approved as soon as possible so that they may make proper course selections. The transfer student submits the completed Student Planning Worksheet for lower division and/or upper division course transfer, all relevant transcripts, and sometimes course descriptions, to the Program Head for evaluation. Once transfer courses are approved as indicated on page 4 of the Student Planning Worksheet by the Program Head’s signature, these courses are recorded in a computer database to be used later for prerequisite checking each semester.

**Lower Division Meeting**

The purpose of the Lower Division Meeting is to present important information to students, such as the various university policies, proper academic loads for full time as well as part time students, where to get help, which Physics, Chemistry, Engineering and Math courses to take, the proper course sequence in which they should be taken, and other important subjects.
Civil Engineering Meeting

The Program Head of Civil Engineering hosts this meeting to discuss relevant issues such as new curriculum, new courses, what is happening in the Civil Engineering program, solicit comments and inputs from students, and so on. During the mandatory advising week, students must pick up their Student Planning Worksheet from the Engineering Office so that they can update it. All required and elective Engineering courses are clearly listed in the Student Planning Worksheet and students need to fill out when they took those Engineering courses and indicate the grades received. Thus, the Student Planning Worksheet is a great tool for both the student and the advisor to keep track of student's academic progress and to identify potential problems. All upper division students are assigned a Faculty Advisor, who advises students on both curricular and career issues. During Advising Week each student can meet with his/her advisor to review progress and to have any questions answered by the advisor.

By the end of Advising Week, all Student Planning Worksheets are collected, and advisors or Program Heads sign and date the Student Planning Worksheet, verifying that the student did attend the mandatory meeting. The Engineering Office then compiles a list of students who failed to attend the mandatory advising meeting based on the collected Student Planning Worksheets. This list is submitted to the Registrar's Office, which places an advising hold on them. These students are not able to register unless they come into the Engineering office to see the School Director or Program Head to get advised. The Engineering Office then releases the advising hold on the same day so that students can register for classes.

General Education Advising

All engineering students, both lower and upper divisions, are advised to plan their General Education (GE) program with the assistance of either (i) the dedicated GE advisor from within the School of Engineering, who is also a faculty member and is available by appointment, or (ii) counselors from the Undergraduate Advising Center (located in Room 211 in the Administrative Building) available on a walk-in basis from Mondays through Thursdays. The current dedicated GE advisor from the School of Engineering is Dr. K. S. Teh, who advises engineering students on GE matters on a weekly basis.

General Education Meeting

A GE meeting is held at least once per semester, in conjunction with our New and Transfer Student Orientation. Although it is not mandatory for engineering students to attend the GE meeting, the School of Engineering actively encourages students to attend the meeting. This is due to the fact that SFSU implemented new GE requirements beginning Fall 2014 semester, which affects students who were admitted from Fall 2014 semester onwards. At the same time, the GE requirements for students admitted prior to Fall 2014 semester remained unchanged. During the GE meeting, Dr. K. S. Teh addresses the GE requirements for both sets of students in
order to clarify the specific requirements for each, and to make sure that students do not eventually end up taking more GE units than they otherwise need. All in all, the goal is ensure students can graduate on time and not being held up by excessive GE units. As such, the GE meeting is usually well attended even though it is not mandatory.

E. Work in Lieu of Courses

In the last six years the Civil Engineering Program has not accepted any work in lieu of any course for credit toward graduation. We have accepted Advanced Placement coursework (taken while the student is in high school) approved by the university for calculus, chemistry and physics. We have no policy for accepting life experience, dual enrollment, test out, or military experience and have not awarded any course credit for any of these forms of experience.

F. Graduation Requirements

The degree we offer is called Bachelor of Science in Civil Engineering. It requires 127 semester units. This degree has the following requirements:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of required semester units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Courses (for ALL civil engineering students):</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics</td>
<td>15</td>
</tr>
<tr>
<td>Required Civil Engineering</td>
<td>49</td>
</tr>
<tr>
<td>Elective Civil Engineering</td>
<td>12</td>
</tr>
<tr>
<td>General Education courses (For students admitted prior to Fall 2014):</td>
<td></td>
</tr>
<tr>
<td>English (Written Communication)</td>
<td>6</td>
</tr>
<tr>
<td>US History and US/CA Government</td>
<td>6</td>
</tr>
<tr>
<td>Speech (Oral Communication)</td>
<td>3</td>
</tr>
<tr>
<td>Behavior and Social Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Humanities and Creative Arts</td>
<td>6</td>
</tr>
<tr>
<td>Culture and Ideas</td>
<td>6</td>
</tr>
<tr>
<td>General Education courses (For students admitted during and after Fall 2014):</td>
<td></td>
</tr>
<tr>
<td>Area A</td>
<td>9</td>
</tr>
<tr>
<td>Area B</td>
<td>3</td>
</tr>
<tr>
<td>Area C</td>
<td>9</td>
</tr>
<tr>
<td>Area D</td>
<td>9</td>
</tr>
<tr>
<td>Area UD</td>
<td>6</td>
</tr>
</tbody>
</table>
The details of these requirements (excluding General Education) with the topics being Required Science, Required Lower Division Engineering, Required Upper Division Engineering, Elective Upper Division Engineering and Technical Elective are:

### Required Science

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 180</td>
<td>Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Math 226</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>Math 227</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>Math 228</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>Math 245</td>
<td>Differential Equations and Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Physics 220 and 222</td>
<td>Physics I with lab</td>
<td>4</td>
</tr>
<tr>
<td>Physics 230 and 232</td>
<td>Physics II with lab</td>
<td>4</td>
</tr>
<tr>
<td>Physics 240 and 242</td>
<td>Physics III with lab</td>
<td>4</td>
</tr>
<tr>
<td>Life Science Elective</td>
<td>(elective; part of General Education reqs.)</td>
<td>3</td>
</tr>
</tbody>
</table>

### Required Lower Division Engineering

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Course Number</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr 100</td>
<td>Introduction to Engineering</td>
<td>1</td>
</tr>
<tr>
<td>Engr 101</td>
<td>Engineering Graphics</td>
<td>1</td>
</tr>
<tr>
<td>Engr 102</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 103</td>
<td>Introduction to Computers</td>
<td>1</td>
</tr>
<tr>
<td>Engr 200</td>
<td>Materials of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Engr 201</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 205</td>
<td>Electronic circuits</td>
<td>3</td>
</tr>
<tr>
<td>Engr 235</td>
<td>Surveying</td>
<td>3</td>
</tr>
</tbody>
</table>

### Required Upper Division Engineering

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr 300</td>
<td>Engineering Experimentation</td>
<td>3</td>
</tr>
<tr>
<td>Engr 302</td>
<td>Engineering lab</td>
<td>1</td>
</tr>
<tr>
<td>Engr 304</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 309</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>Engr 323</td>
<td>Structural Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Engr 425</td>
<td>RC Structures</td>
<td>3</td>
</tr>
<tr>
<td>Engr 429</td>
<td>Construction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Engr 430</td>
<td>Soil Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 434</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Engr 436</td>
<td>Transportation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Engr 696</td>
<td>Engineering Design Project I</td>
<td>1</td>
</tr>
<tr>
<td>Engr 697</td>
<td>Engineering Design Project II</td>
<td>2</td>
</tr>
</tbody>
</table>
**Elective Upper Division Engineering (Student must choose 12 units from the following)**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr 303</td>
<td>Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 426</td>
<td>Steel Design</td>
<td>3</td>
</tr>
<tr>
<td>Engr 427</td>
<td>Wood Design</td>
<td>3</td>
</tr>
<tr>
<td>Engr 431</td>
<td>Foundation Design</td>
<td>3</td>
</tr>
<tr>
<td>Engr 435</td>
<td>Environmental Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>Engr 439</td>
<td>Construction Cost and Scheduling</td>
<td>3</td>
</tr>
<tr>
<td>Engr 441</td>
<td>Fundamentals of Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>Engr 461</td>
<td>Mechanical and Structural Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>Engr 468</td>
<td>Applied Fluid Mechanics and Hydraulics</td>
<td>3</td>
</tr>
<tr>
<td>Engr 469</td>
<td>Renewable Energy Systems</td>
<td>3</td>
</tr>
<tr>
<td>Engr 610</td>
<td>Engineering Cost Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**G. Transcripts of Recent Graduates**

The program will provide transcripts of recent graduates as they are requested.
CRITERION 2: PROGRAM EDUCATIONAL OBJECTIVES

The stated ABET Criterion is:

“The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program’s various constituencies, and these criteria. There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review and revision of these program educational objectives that ensures they remain consistent with the institutional mission, the program’s constituents’ needs, and these criteria.”

A. Mission Statement

At its meeting of February 10, 2015, the Academic Senate approved the following mission for San Francisco State University:

From the heart of a diverse community, San Francisco State University honors roots, stimulates intellectual and personal development, promotes equity, and inspires the courage to lead, create, and innovate.

SF State is a major public urban university, situated in one of the world's great cities. Building on a century-long history of commitment to quality teaching and broad access to undergraduate and graduate education, the University offers comprehensive, rigorous, and integrated academic programs that require students to engage in open-minded inquiry and reflection. SF State encourages its students, faculty, and staff to engage fully with the community and develop and share knowledge.

Inspired by the diversity of our community that includes many first-generation college
students, and the courage of an academic community that strives to break down
traditional boundaries, SF State equips its students to meet the challenges of the 21st
century. With the unwavering commitment to social justice that is central to the work of
the university, SF State prepares its students to become productive, ethical, active
citizens with a global perspective.

The university mission statement can be found in the university catalog and on the university

B. Program Educational Objectives

The Civil Engineering Program of the School of Engineering has the following educational
objectives:

Graduates of the civil engineering program are expected to have, within a few years of
graduation:

1. Established themselves as practicing professionals or engaged in
   graduate study in civil engineering or a related field.
2. Become licensed civil engineers or made appropriate progress
toward professional registration.

The Civil Engineering objectives are published widely. They are shown in the following places:

1. The university bulletin
2. The School of Engineering website
3. Student advising instruction sheets
4. Signs posted in the School of Engineering hallways and classrooms

C. Consistency of the Program Educational Objectives with the Mission of
the Institution

The program educational objectives are consistent with the San Francisco State University
mission statement in that they both emphasize:
1. Professional development – Our objectives emphasize professional practice in civil engineering or pursuing further education in graduate school. The university’s mission similarly emphasizes “intellectual and personal development” and to “develop and share knowledge”.

2. Contribution to the community – Our objectives, by focusing on professional practice in civil engineering mean that our students are encouraged to contribute in this manner to the community. The university’s mission similarly states, “SF State prepares its students to become productive, ethical, active citizens with a global perspective”.

3. Striving for excellence – Our objectives emphasize professional registration. The university’s missions states, “SF State equips its students to meet the challenges of the 21st century”. These both reflect striving for excellence.

The Civil Engineering Objectives are also consistent with the School of Engineering’s mission statement, which is:

To educate students from a diverse and multicultural population to become productive members of the engineering profession and society at large.

It is also believed that these objectives are consistent with the ABET criteria 1-9 (not shown here) for engineering and civil engineering.

The objectives are consistent with the mission statements and the ABET criteria because all of them are focused on promoting:

1. Learning.
2. Accomplishments for graduates.
3. A view of helping society as a whole.

D. Program Constituencies
The Civil Engineering objectives have a development and modification process that has input from the program’s significant constituencies to assure that it meets their needs. The constituencies include engineering students, alumni, faculty, employers and industry representatives.

The program educational objectives meet the needs of the constituencies in the following ways:

1. Engineering students and alumni – The objectives encourage professional development and success. They encourage lifelong learning and continuous improvement in student and alumni capabilities.
2. Faculty – The objectives encourage faculty to teach appropriate analysis, design and communication skills to students so they can engage in professional practice. Faculty also should prepare students to pass the required professional engineering exams.
3. Employers and industry representatives – The objectives aim to create a knowledgeable and prepared workforce. This workforce can communicate and learn new skills. This all benefits employers and local industry.

E. Process for Review of the Program Educational Objectives

The objectives (assessment and development) and outcomes (assessment and development) processes are intertwined. Figure 2.1 illustrates schematically an overview of how the process has worked in our program. This figure is not meant to show a step-by-step process or a timetable but to illustrate how processes contributed to the development and modification of other processes. This figure shows that in developing our objectives we created our objectives assessment process. We also assured that our outcomes (outcomes development process) correlate with the ABET outcomes and reviewed our outcomes assessment process. We used outcomes assessment to help us modify curriculum content. Our outcomes assessment process helped us develop our objectives assessment process.
Fig 2.1: Overview of development and Assessment process for Objectives and Outcomes.

The process for modifying our objectives is this:
The program’s educational objectives are reviewed by the Outcomes Assessment Committee (OAC) which is the same as the Program Heads committee. The objectives are reviewed by the OAC and the school director. Modifications are then suggested (using knowledge of and results of other processes) that make the objectives easily assessable, more compatible with the current environment and thinking regarding engineering education, and more reflective of the needs and requirements of the constituencies and ABET. These modifications are then presented to the programs constituencies in the form of focus groups or individual discussion to get input. The input is then reviewed by the OAC and director and finalized for submittal to ABET. Figure 2.2 shows the process in a flow chart.

The Outcomes Assessment Committee is assembled by the school director and comprises one member from each program and two members-at-large appointed by the school director. The school director appoints the committee chair. The charge of the committee with regard to objectives is to survey the school’s significant constituencies, evaluate their inputs, and propose necessary modifications to the program objectives. The committee ensures that the program objectives are compatible with and support the university’s and school’s mission. The OAC reviewed our current objectives and found them to be acceptable for this accreditation review cycle. Figure 2.2 shows an overview of the process for assessing the appropriateness of the program educational objectives. This process is done on a six year cycle. It was performed in 2012 and will be done again in 2018.
Figure 2.2: Process for Assessing the Appropriateness of the Program Educational Objectives
CRITERION 3: STUDENT OUTCOMES

A. Student Outcomes

Student outcomes for all School of Engineering programs are equivalent to those outlined by ABET Criterion 3. Namely, by the time of graduation, students are expected to attain:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The San Francisco State University Civil Engineering outcomes are the same as the ABET outcomes. They are documented at http://engineering.sfsu.edu/academics/undergraduate-major/civil/overview_and_description.html

B. Relationship of Student Outcomes to Program Educational Objectives
The Civil Engineering Program of the School of Engineering has the following educational objectives:

*Graduates of the civil engineering program are expected to have, within a few years of graduation:*

1. *Established themselves as practicing professionals or engaged in graduate study in civil engineering or a related field.*
2. *Become licensed civil engineers or made appropriate progress toward professional registration.*

Table 3.1 lists the student outcome(s) and parses out the objectives into their individual components to describe how the outcomes support the objectives.

**Table 3.1:** Civil Engineering program educational objectives (parsed out into individual components) and Associated Student Outcomes.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>How outcome prepares graduates to attain the program educational objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) an ability to apply knowledge of mathematics, science, and engineering</td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. These are the basic skills needed by all civil engineers.</td>
</tr>
<tr>
<td>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. Experimental work and understanding the results is necessary both in practice and in passing the PE exam.</td>
</tr>
<tr>
<td>(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic,</td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. Design is necessary for both objectives.</td>
</tr>
<tr>
<td><strong>environmental, social, political, ethical, health and safety, manufacturability, and sustainability</strong></td>
<td>These skills are needed for becoming a practicing professional. Effective teamwork is essential for practicing engineers.</td>
</tr>
<tr>
<td><strong>(d) an ability to function on multidisciplinary teams</strong></td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. These are basic skills.</td>
</tr>
<tr>
<td><strong>(e) an ability to identify, formulate, and solve engineering problems</strong></td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. Engineers need to be both professional and ethical.</td>
</tr>
<tr>
<td><strong>(f) an understanding of professional and ethical responsibility</strong></td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. Engineers need to be both professional and ethical.</td>
</tr>
<tr>
<td><strong>(g) an ability to communicate effectively</strong></td>
<td>These skills are needed for becoming a practicing professional. All engineering projects required effective communication.</td>
</tr>
<tr>
<td><strong>(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context</strong></td>
<td>These skills are needed for becoming a practicing professional and obtaining a PE license. A modern engineer needs this education.</td>
</tr>
<tr>
<td><strong>(i) a recognition of the need for, and an ability to engage in life-long learning</strong></td>
<td>These skills are needed for becoming a practicing professional. Engineers must keep up with the changing times.</td>
</tr>
<tr>
<td><strong>(j) a knowledge of contemporary issues</strong></td>
<td>These skills are needed for becoming a practicing professional. Successful engineers need to know contemporary issues.</td>
</tr>
<tr>
<td><strong>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</strong></td>
<td>These skills are needed for becoming a practicing professional. These basic skills are crucial.</td>
</tr>
</tbody>
</table>
With regards to possessing effective analysis skills, students graduating from the program will have obtained a sound foundation in mathematics and science, as well as fundamental engineering topics [outcome (a)]. They will possess an ability to utilize that knowledge in formulating and solving engineering problems [outcome (e)]. In addition, they will have learned how to design and conduct experiments and appropriately analyze and interpret experimental data [outcome (b)].

Oral and written communication skills are heavily emphasized by the School of Engineering in all lab courses, many lecture courses, and the senior capstone design course [outcome (g)]. Lab courses and the senior capstone design course also require the ability to work well in multidisciplinary teams [outcome (d)].

Of course, these program educational objectives cannot be met if these associated skills are not effectively utilized by our graduates in the engineering profession; thus outcome (k) plays a critical role in each of them.

Our program’s emphasis on lifelong learning [outcome (i)] and current engineering advances and issues [outcome (j)] are designed to instill in our graduates an understanding of the importance of continuing education and learning.

Professionalism and ethical and social awareness are directly supported by outcomes (f) and (h). Since our program instructs students to communicate professionally in written reports and oral presentations, outcome (g) also contributes.
CRITERION 4: CONTINUOUS IMPROVEMENT

The stated ABET Criterion is:

“The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.”

We continually improve the Civil Engineering program at SFSU. The improvements are based on available information from a number of sources including results from Criteria 2 and 3 processes.

Both our program educational objectives and outcomes have an assessment and evaluation process that periodically documents and demonstrates the degree to which these objectives and outcomes are attained. We use both for continuous improvement.

A. Student Outcomes

We believe that in assessing the achievement of our objectives that we also learn something about the achievement of our outcomes. In this section, we first present our objectives assessment and how this assessment helps us with our outcomes then we show our outcomes assessment.

Student Outcomes – Objectives assessment verifying attainment of outcomes:

The Civil Engineering Program of the School of Engineering has the following educational objectives:

Graduates of the civil engineering program are expected to have, within a few years of graduation:

1. Established themselves as practicing professionals or engaged in graduate study in civil engineering or a related field.
2. Become licensed civil engineers or made appropriate progress toward professional registration.

The process for assessing and evaluating the degree of attainment of our objectives is illustrated in Fig. 4.1.
As can be seen from the figure, we solicit input from alumni in the form of surveys.

Primary emphasis is put on the evaluation of the accomplishments of the program alumni (that is, greater emphasis is put on accomplishments rather than opinions of alumni and employers). In assessing our objectives, we keep in mind our outcomes. We look at the following with regard to the surveys:

1. Steps made toward professional registration.
2. Significance of projects in which alumni are involved and the level of supervisory role in projects.
3. Alumni assessment of level of accomplishments, communication skills, ethics and awareness of economic, environmental, ethical and social factors affecting their work.

The results are used together with the data of the objectives and our outcomes assessment evaluation to determine the degree of attainment of our outcomes. The cycle for objective assessment is every six years. The Director of the School of Engineering keeps and maintains all records. We expect alumni to have significant involvement in analysis and design. We expect that they are competent in communications, teamwork, and professional practice. We expect them to show awareness of the economic, ethical, environmental and social factors affecting their work.
Student Outcomes - Alumni Survey Results:

A total of 31 civil engineering alumni completed a five page survey created by the civil engineering faculty. The survey gathered information on both the accomplishments and opinions of our former students. The average time outside SFSU for the alumni surveyed was approximately 7.7 years. Most of them were in the range of 3 to 10 years after graduation. The survey was broken up into eight topics related to the program objectives. We set an acceptance rate of 50%. The percentage results are in Table 4.1.

Table 4.1 Alumni survey percentage results

<table>
<thead>
<tr>
<th>Topic</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE exam</td>
<td>88.5% have passed the FE exam</td>
</tr>
<tr>
<td>PE exam</td>
<td>37.9% have taken the PE exam. 90.9% of those who have taken the exam, have passed the exam.</td>
</tr>
<tr>
<td>Specialty exam (SE or GE)</td>
<td>10% of those passing the PE exam, have taken a specialty exam. 0% of those taking the specialty exam, passed.</td>
</tr>
<tr>
<td>Career advancement</td>
<td>71.4% have received a promotion during their career. 96.7% believe their career has advanced at a satisfactory pace.</td>
</tr>
<tr>
<td>Lifelong learning and professional service</td>
<td>65.5% have attended a conference or short course. 34.5% have earned a graduate degree. 59.4% believe that their undergraduate education at SFSU trained them to acquire professional knowledge on their own. 65.5% belong to ASCE or another professional organization. 62.5% believe they are well-grounded in professional ethics and civic responsibilities.</td>
</tr>
<tr>
<td>Communication skills</td>
<td>57.1% routinely write reports. 71.4% routinely make presentations. 60% believe their reports are written effectively. 73.1% believe their presentations are clear and well received. 64.5% believe that the communication skills taught at SFSU are very useful to them professionally. 62.5% believe they communicate effectively at work.</td>
</tr>
<tr>
<td>Analysis and design skills</td>
<td>59.4% believe the analytic skills they acquired at SFSU have served them well professionally. 56.3% believe their design skills with specialized software have served them well professionally. 56.4% believed the “hands-on” experience with engineering instrumentation they received at SFSU was useful in their entry level job.</td>
</tr>
</tbody>
</table>
Teamwork

86.2% work in teams on their professional projects. Of those, 63.3% believe their teams are effective. 59.4% believe they were a strong contributor or leader in some aspect of the team work.

Except for taking and passing a specialty exam and attending graduate school, we have met the acceptance rate.

**Student Outcomes - Alumni Employers, Titles, and Projects:**

On the alumni survey we asked them to supply their current employer, title, and two recent projects and roles they played. The information they gave us is given in Table 4.2 as direct quotes from the surveys.

**Table 4.2 Alumni survey employers, titles and projects results**

<table>
<thead>
<tr>
<th>ID</th>
<th>Year of graduation</th>
<th>Organization</th>
<th>Title</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2005</td>
<td>S&amp;K Consulting</td>
<td>Owner</td>
<td>Filbert Street Shoring – Design shoring system SF Apartment – Seismic upgrade</td>
</tr>
<tr>
<td>3</td>
<td>2012</td>
<td>NINYO&amp;MOORE</td>
<td>Staff Engineer</td>
<td>(1) Sorrento valley double track – performed sampling or geotechnical evaluation for the construction of new rail track, and then observed pile drilling operations. (2) National city aquatic center – performed stone column installation observation and calculate dynamic settlement upon completion of the ground improvement.</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>URS</td>
<td>Project Engineer</td>
<td>*San Bruno Grade Separation *SR 4 widening &amp; Bart Station *Hillcrest Ave Bridge widening *Pedestrian Overcrossing Bridge on</td>
</tr>
<tr>
<td>No.</td>
<td>Date</td>
<td>Company/Project</td>
<td>Position</td>
<td>Experience/Activities</td>
</tr>
<tr>
<td>-----</td>
<td>------------</td>
<td>-------------------------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
(2) Preparing database in Timberline for estimating purpose according to RS means & user input. |
| 6   | 2014       | California Engineering Contractors Inc.    | Field Engineer          | *Bay Bridge Demo Project                                                                |
| 7   | 2013       | PWA, City of Oakland                      | Engineer Intern         | *Traffic signal project Drafted the utilities lines by using AutoCAD                     
*Input the electronic traffic signal database.  
*Prepare work order by using AutoCAD.  
Time delay error for hybrid simulation  
*Use Matlab to do the time delay error analysis. |
| 8   | B.S. c/o 2010; M.S. c/o 2012 | Alta Vista Solutions | Lead Quality Engineer | California High Speed Rail Program: I supervise a consultant team of 6 persons for systems assurance for the California High Speed Rail Authority.  
My team is responsible for developing, implementing, monitoring, and improving the quality management system, assisting in the procurement and contracting of Authority consultants and contractors, and developing, implementing, and monitoring the security and safety program for the Authority.  
BART Silicon Valley Berryessa Extension Design/Build Project: I was a member of the independent design review team for the structural design |
<table>
<thead>
<tr>
<th>9</th>
<th>2012</th>
<th>E2 Consulting Engineers</th>
<th>Associate Engineer</th>
<th>of the Milpitas and Berryessa stations and pedestrian bridge. I was responsible for the computer modelling using SAP2000 for the pedestrian bridge, Milpitas BART station, and the final independent design review report. I also mentored junior engineers through the civil-site design of parking lots.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2012/2013</td>
<td>Blair, Church &amp; Flynn Consulting Engineers</td>
<td>SWPPP Coordinator, Assistant Engineer</td>
<td>Two recent projects are Brentwood terminal and Dalton Crossover projects. PG&amp;E is upgrading existing valves with remote control functionality. As an Associate Engineer (contractor for PG&amp;E), I solve the issues and challenges facing my projects and make sure the project is completed on Budget/schedule. I analyze existing gas pipeline systems and coordinate the construction with various functional groups. In addition, I check the materials codes, coordinate materials delivery time with suppliers, verify work progress with field engineer, check engineering plans and drawings, obtain required permits, and estimate the project cost.</td>
</tr>
<tr>
<td>11</td>
<td>2013</td>
<td>Campos EPC</td>
<td>Project</td>
<td>L-109 gas transmission pipeline</td>
</tr>
<tr>
<td>No.</td>
<td>Year</td>
<td>Company/Position</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>2009</td>
<td>AECOM Staff engineer (Manager)</td>
<td>Replace 5 miles of gas transmission. Next 2 years, replace 7 miles of gas transmission pipeline.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ULE - Urban level evaluation program</td>
<td>ULE-Urban level evaluation program – seepage, stability and safety evaluation of central valley levels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SR-91 DB-Geotechnical Services for</td>
<td>SR-91 DB-Geotechnical Services for State Route 91 corridor Improvement Project – shallow/deep foundation analysis, geotechnical exploration program, seismic analysis.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>2015</td>
<td>Herrero Boldt Project Engineer (Staff)</td>
<td>Van Ness &amp; Geary Hospital -Project engineer for Medical Equipment -Coordination, revision of floor plans, review BIM Model, site walls</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>2013</td>
<td>Strandberg Engineering Design Engineer</td>
<td>Renovation of a house, lower the basement design with new mat slab, and concrete retaining walls. Design gravity framing and lateral analysis. The house is located in Palo Alto.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dec. 2014</td>
<td>Calwest Geotechnical Staff Engineer</td>
<td>*Litchfield Capital LLC, provide mitigation methods for 3 residential developments underlying landslide debris. *Arnold Schwarzenegger garage, provide design loads for subterranean garage.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>2013</td>
<td>McCarthy Building Inc. Project Engineer</td>
<td>*Bay area Head quartered authority *Caltrans</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2005</td>
<td>1. HCDesign Principal</td>
<td>400 BAY (New hotel)- P.M. Brisbane Condo (New) – P.M.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. RMJ Structural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>2005</td>
<td>City &amp; County of San Francisco water department Associate Engineer</td>
<td>1) Crystal Springs San Andreas Transmission line construction Field Contract Administration. Review contract changes, request for informatics, charges.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) Biohabitat regional program –</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Year</td>
<td>Date</td>
<td>Firm/Project Description</td>
<td>Role/Position</td>
</tr>
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<td>-----</td>
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<td>-------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>19</td>
<td>2013</td>
<td>Dec.</td>
<td>ENGEO</td>
<td>Staff Engineer</td>
</tr>
<tr>
<td>20</td>
<td>2014</td>
<td>BKF Engineers</td>
<td>Design Engineer</td>
<td>No response</td>
</tr>
<tr>
<td>22</td>
<td>2015</td>
<td>No response</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td>23</td>
<td>2014</td>
<td>EBMUD</td>
<td>Junior Engineer</td>
<td>No response</td>
</tr>
<tr>
<td>24</td>
<td>2015</td>
<td>City and county of San Francisco</td>
<td>Project Management Intern</td>
<td>No response</td>
</tr>
<tr>
<td>26</td>
<td>1992</td>
<td>Caltrans</td>
<td>Senior Engineer</td>
<td>No response</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Year</td>
<td>Company</td>
<td>Position</td>
<td>Projects/Responsibilities</td>
</tr>
<tr>
<td>-----</td>
<td>------</td>
<td>----------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>27</td>
<td>2014</td>
<td>EBMUD</td>
<td>Junior civil engineer</td>
<td>No response</td>
</tr>
<tr>
<td>28</td>
<td>2013</td>
<td>ENGEO</td>
<td>Project Engineer</td>
<td>River Islands- Levees, slope stability, soil strength, include deep foundations, some retaining walls. Soil site in Aubrey- pile recommendation in Wood-Lode fill material.</td>
</tr>
<tr>
<td>31</td>
<td>2005</td>
<td>City of San Francisco</td>
<td>Engineer</td>
<td>1. Crystal Springs San Andreas pipeline (135m) project construction engineer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Biohabitat Regional Habitat Restoration (25m), project construction engineer.</td>
</tr>
</tbody>
</table>
**Student Outcomes - Alumni view of Strengths of our Civil Engineering Program and Suggestions for Improvement:**

On the alumni survey we asked them to describe the strengths of our program and ways it can be improved. The information they gave us is given in Table 4.3 as direct quotes from the surveys.

**Table 4.3 Alumni survey strengths and improvements results**

<table>
<thead>
<tr>
<th>ID</th>
<th><strong>Strength</strong></th>
<th><strong>Suggested Improvements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smaller class size allows better interaction with professors. Counselors are very helpful.</td>
<td>Could use more internship positions to gain more job opportunities.</td>
</tr>
<tr>
<td>2</td>
<td>Tight knit graduating class of 1990. Well rounded course curriculum with senior project experience and ASCE activities helped me prepare for my career.</td>
<td>It was the best university for me coming out of high school. I would not be an engineer if it wasn’t for SFSU. AL LEE, SFSU grad 1990 ALFRED LEE.</td>
</tr>
<tr>
<td>3</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td>4</td>
<td>I think my strength that I learn from SFSU which is Construction management &amp; Structural Design.</td>
<td>Teach more construction management, transportation and open up a PhD degree program.</td>
</tr>
<tr>
<td>5</td>
<td>(1) Trains students how to work as a team &amp; record findings and information they learned. (2) Project management made me really aware of many aspects to which my judgment should be based on. Ex: Estimating &amp; Scheduling.</td>
<td>I guess it could improve if student could take more classes in the management field and make more field trip because the field is really different from class.</td>
</tr>
<tr>
<td>6</td>
<td>Team Projects and Engineer Labs.</td>
<td>More construction based classes.</td>
</tr>
</tbody>
</table>
| 7  | *have good professors and advisors.  
*help student get job.  
*Easy get the add code.                                                                                                                                              | *The lab equipment should be improved.  
*Provide more software like SOLIDWORKS.                                                                           |
| 8  | The program at SFSU offers education and training in areas that I have found incredibly valuable as a professional civil engineer – communication and teamwork. SFSU’s program does this successfully without compromising the technical                              | SFSU’s civil engineering program is structured to provide industry-ready engineers ready to analyze, calculate, write, and collaborate; |
importance of engineering (i.e., engineering design, research, instrumentation, field work, engineering analysis, etc.). Civil engineering projects rely on consistently correct technical engineering analysis and professional judgment; however, it’s been proven in project management research and in mega infrastructure projects, like the Bay Bridge project, that communication, transparency, teamwork, and trust are critical to success. SFSU civil engineering and the ability to communicate and recognize the need to work collaboratively.

<table>
<thead>
<tr>
<th>SFSU civil engineering program offers a great opportunity for students to gain knowledge and get ready for their professional careers. One advantage of studying Civil engineering at SFSU is the size of the classroom that allows the student to ask questions and discuss the material with the professor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFSU Civil engineering program can be improved if additional funding is allocated to the program to buy advanced equipment's. Similar to Universities like UC Berkeley.</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No response</th>
</tr>
</thead>
<tbody>
<tr>
<td>More real life project like senior project, more permitted advice, more Autocad.</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

| The program is well rounded and when we get in the job, we don’t “apply” all of our knowledge but we know what is being dismissed and I’m not caught off guard. My engineering intuition makes understanding my ride and tasks easier. |
| Discuss the implication and permits and environments + biological construction that can change a design. Though we may not be running calculation, we are still heavily in the design process. |
| 11 |

<table>
<thead>
<tr>
<th>-CE program is industry/practice oriented. -Well prepares for professional exams PE,FE</th>
<th>Invest more money into educational process. Better pay to professors (at least match industry rates), invest into instrumentation in labs, software packages used by industry companies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

9

10

11

12
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>13</td>
<td>Most of the courses demand a lot of practice, which in the end is great to understand the subjects one is studying. Group project – you learn how to talk/deal with people, communication skill improve. Professors that care about your career path.</td>
<td>Offer students more exposure to construction sites &amp; construction terminology. Require or make internship available to students.</td>
</tr>
<tr>
<td>14</td>
<td>The strengths are the intensity of soil mechanic class, solid of material, structural analysis. Those classes really helped me in my profession.</td>
<td>More projects such as designing a whole building. From ground to top. Do foundation design. Lateral seismic analysis. Gravity framing (wood and steel)</td>
</tr>
<tr>
<td>15</td>
<td>D’Orazio’s stories about professional aspects. The way he teaches, makes you actually study.</td>
<td>Hiring more teacher like D’Orazio teachers with work experience and who care about the students.</td>
</tr>
<tr>
<td>16</td>
<td>Projects were strong and interesting. Geotech &amp; structural were very well delivered which helped my career. Construction management courses are well related to the industry today.</td>
<td>More construction management programs and courses. More software. Internship programs. Need more focuses for the graduate program. More field visits to companies.</td>
</tr>
<tr>
<td>17</td>
<td>Successful ticket for career access.</td>
<td>My year is a little outdate. Hopefully using the latest programs such as AutoCAD, ENERCAL, RISA2D,3D,SAP…. I do recommend to have a class to teach how to read Construction drawing.</td>
</tr>
<tr>
<td>18</td>
<td>The knowledge we received during the full program were very useful, the courses I took were useful, the thesis and senior me with my ability to date. The psychical knowledge I received in management course are very useful.</td>
<td>I only have one suggestion to add construction management in master’s program. Otherwise it is very good program.</td>
</tr>
<tr>
<td>19</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td>20</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td>21</td>
<td>SFSU’s CE program prefers its graduates with strong oral and written communication skills. Preparation for working in a tension environment is also a strength. Graduates of the program are well prepared to apply engineering theory to real world problems.</td>
<td>Train students look further beyond the technical. Connect social and political issues with engineering.</td>
</tr>
<tr>
<td>22</td>
<td>No response</td>
<td>No response</td>
</tr>
<tr>
<td>23</td>
<td>Great community, students and professors all available</td>
<td>The courses could be more</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| **24** | *Very good focus on structural, geotechnical engineering.*  
*Great technical advice for the real world in Engr 696/697.*  
*Great design classes helped me with my analytical skills.*  
*I can use critical thinking to carry out a project or task given to me by boss.*  
*Great teamwork skill.* | *More time focused on construction management (stronger construction class).*  
*A class on field engineering, recognizing the steps in construction phasing and sequencing.*  
*A class on construction material and equipment.* |
| **25** | Ability to solve real world problems. Ability to communicate orally and in writing. | Environmental laws and permitting are now taking much a large amount of design resources. Need to have a more thorough knowledge in this area. Also need understanding of finances construction ability, and maintainability. |
| **26** | Good, practical | None |
| **27** | No response | No response |
| **28** | As a geotech the course works in practices. Got great background in structural. | More program. More diversity. |
| **29** | Excellent program. | N/A |
| **30** | Writing skills. | Design. |
| **31** | The civil engineering prepared me to think about one project in entirety and prepared to manage instead of concentrating in individual subject. | I would like to see more management and leadership selected subjects to be taught. |
Student outcomes - Evaluation of objective assessment:

For reference, our objectives are repeated here:

Graduates of the civil engineering program are expected to have, within a few years of graduation:

1. Established themselves as practicing professionals or engaged in graduate study in civil engineering or a related field.
2. Become licensed civil engineers or made appropriate progress toward professional registration.

We believe that our civil engineering program has met all of its objectives. We set an acceptance criteria of 50%.

Objective 1- The alumni surveys indicate that the vast majority (100% in our current survey) of our students have become accomplished and successful civil engineers. Our students have worked on a large number of significant projects. They are employed by significant private engineering firms and public engineering organizations. Also, 34.5% of those have obtained a graduate degree in addition to being a successful engineer. From this data, we see that our percentage is greater than 50%, and we have met Objective 1.

Objective 2- Our alumni have made significant progress toward professional registration. A total of 88.5% have passed the FE exam. Of those taking the PE exam, 90.9% have passed. Again, our percentage is greater than 50% and we have met Objective 2.

Student Outcomes – Outcomes Assessment:

An overview of the assessment process for student outcomes in presented in Figure 4.2. The primary vehicles for outcomes assessment are alumni surveys, student surveys, and course-based assessment. The information is documented and maintained by the Director of the School of Engineering.

Cycles – Since our last accreditation visit, alumni surveys took place in –2012, 2014, 2015 and 2016, and will be done again in 2018, 2020, 2022 and 2024. Student surveys were done in 2013, 2014, and 2015 and will continue to be done approximately every other year. Course-based assessment has been done in years --2012 and 2015 and will continue to be done repeatedly until our next accreditation visit.
The outcomes we use are the same as ABET and are repeated here for reference:--

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Student Outcomes – Evaluation of Alumni Surveys:**

We first evaluate the results of our alumni surveys with respect to outcomes. We use above 50% as acceptance criteria.

**Analysis and Design (Outcomes a, b, c, e, and k)** We asked our alumni to describe projects they had recently worked on and the role they played. We did not prompt them in any way to use any words such as design. However, the word “design” appears 20 times in Table 4.2 in both the descriptions of the work and job title. Three had the title of Design Engineer. We believe this illustrates that our alumni are heavily engaged in design projects and that this is evidence in terms of us preparing students for design work. Regarding analysis, nearly 60% believe that the analytic skills they learned at SFSU served them well professionally. Since analysis is a part of design and the opinions of our alumni are favorable regarding what they learned in analysis, we believe that this is further evidence of us preparing students for analysis.

**Communication skills (Outcome g)** More than 53% of our alumni routinely write reports, and more than 66% routinely make presentations. Clearly, if they were not effective communicators, their employers would not have them routinely performing these activities. That they are given these responsibilities indicates that their employers have faith and confidence in their communication skills. We believe that this is evidence of us effectively teaching communication skills.

**Teamwork. (Outcome d)** More than 86% work in teams on their projects. This alone does not prove that they have effectively learned teamwork because their organizations may always work
in teams. Carrying some weight is their opinions of their teams’ effectiveness and their own effectiveness on those teams. More than 63% believe their teams are effective and nearly 60% believe they were strong contributors in the team work. In addition, without prompting, 5 alumni stated that one of the Civil Engineering program’s strengths is in teaching teamwork. Given these results, we believe we have effectively taught teamwork.

Awareness of economic, environmental, ethical and social factors. (Outcomes f, h, and j)
Attainment of this is difficult to assess. Opinions rather than actions need to be used to evaluate the effectiveness of our teaching because it is unlikely any of our alumni would have been taken in front of an ethics board on one hand or won an award of some sort regarding any of these factors on the other hand. We recognize that our alumni would be somewhere between these two extremes. In terms of opinions, more than 62% believe they are well-grounded in professional ethics and civic responsibilities and more than 71% feel they perform their duties while being aware of the environmental, ethical and social factors involved. In the absence of other evidence, we believe we have effectively taught economic, environmental, ethical and social factors.

Lifelong learning and professional society involvement. (Outcomes f and i) More than 65% of our alumni have attended a conference or short course, and more than 34% have received a graduate degree. We believe that these numbers indicate that our alumni are very active in lifelong learning and that this is evidence that we effectively teach lifelong learning. In addition to attending conferences, more than 65% of our alumni belong to ASCE or another professional organization. The alumni may not be officers or heavily involved in ASCE but given that they maintain membership and attend conferences, makes us believe that we effectively teach professional society involvement.
Student Outcomes – Evaluation of Student Surveys:

Another important instrument used for evaluating achievement of student outcomes is the senior exit survey. As student outcomes “describe what students are expected to know and be able to do by the time of graduation,” the senior exit survey is a method for evaluating achievement of outcomes. The survey is a paper survey administered toward the end of the semester in ENGR 697: Engineering Design Project II (the second in the sequence of two senior capstone design courses). While a few students taking the course are not truly graduating seniors, we believe it reasonable to expect that all students will have achieved the student outcomes by this point in the Civil Engineering curriculum.
While some questions are used for general data collection and feedback, questions 5 through 18 specifically relate to student outcomes. They are reproduced in Table 4.4, sorted by the (a) through (k) outcomes. Respondents are asked to indicate their level of agreement on a scale of 1 = “strongly agree” to 5 = “strongly disagree”. An average response of 2.25 or better (lower) is considered an acceptable level of attainment.

Exit surveys were given to students in years 2013, 2014, and 2015. They addressed all outcomes (a-k). The same scale as other surveys we have conducted has been used (1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree). The results are presented in Table 4.4.

Table 4.4 Results of Student Exit Surveys

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</thead>
<tbody>
<tr>
<td>5. I have learned to work with others on group projects.</td>
<td>d</td>
<td>1.71</td>
<td>1.33</td>
<td>1.45</td>
</tr>
<tr>
<td>6. I am comfortable dealing with others whose training and expertise are different from my own.</td>
<td>d</td>
<td>1.82</td>
<td>1.41</td>
<td>1.61</td>
</tr>
<tr>
<td>7. I am comfortable speaking in front of a group of my peers</td>
<td>g</td>
<td>2.07</td>
<td>1.56</td>
<td>2.1</td>
</tr>
<tr>
<td>8. I have learned to make effective presentations to peers</td>
<td>g</td>
<td>1.98</td>
<td>1.67</td>
<td>1.96</td>
</tr>
<tr>
<td>9. I have learned to communicate effectively in writing</td>
<td>g</td>
<td>2</td>
<td>1.73</td>
<td>1.86</td>
</tr>
<tr>
<td>10. I have learned to analyze and design systems, components or processes in my field.</td>
<td>a, b, c, e, k</td>
<td>2.14</td>
<td>1.62</td>
<td>1.69</td>
</tr>
<tr>
<td>11. I have learned to use computers to solve engineering problems.</td>
<td>a, b, c, e, k</td>
<td>2.07</td>
<td>2.19</td>
<td>1.91</td>
</tr>
<tr>
<td>12. I have the foundation for learning new information and procedures.</td>
<td>i</td>
<td>1.79</td>
<td>1.53</td>
<td>1.65</td>
</tr>
<tr>
<td>13. I have gained an awareness of the impact of engineering activities in a global and societal context.</td>
<td>h, j, f</td>
<td>2</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>14. I have gained an awareness of how some contemporary issues are related to engineering.</td>
<td>j</td>
<td>2.02</td>
<td>1.79</td>
<td>1.54</td>
</tr>
<tr>
<td>15. I understand my professional and ethical responsibilities as an engineer</td>
<td>f</td>
<td>1.63</td>
<td>1.35</td>
<td>1.45</td>
</tr>
</tbody>
</table>
16. I am aware that I will need to continue learning new information and methods in my professional career.

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>1.54</th>
<th>1.38</th>
<th>1.41</th>
</tr>
</thead>
</table>

17. My senior project was a valuable part of my educational experience.

<table>
<thead>
<tr>
<th></th>
<th>b, c</th>
<th>1.61</th>
<th>1.44</th>
<th>1.53</th>
</tr>
</thead>
</table>

18. I am well prepared to enter my chosen field.

<table>
<thead>
<tr>
<th></th>
<th>c, k</th>
<th>2</th>
<th>1.94</th>
<th>1.82</th>
</tr>
</thead>
</table>

The worst performers were in communications. Some students are still uncomfortable speaking (question 7) and making presentations (question 8) in front of their peers and in writing communication (question 9). We have addressed this communication shortcoming in the following ways. In the senior project courses we brought in an outside speaker to specifically address communications. We asked all faculty to emphasize the importance of communication. We hired a tutor to assist students in their writing.

The surveys show that there was improvement (from 2013 to 2015) in our performance in group projects (question 5), analysis and design (question 10), awareness of engineering on society (question 13), awareness of engineering on contemporary issues (question 14), and in using computers (question 11).

We have worked hard in improving in these areas and this has paid off. We have added computer work in our required courses, particularly Engr 323 Structural Analysis, which is a required course. Also, more emphasis was placed in the senior project courses on a methodology to use advanced computer software. Students were taught how to progress from solving simple problems to complex ones. For contemporary issues, in ENGR 434 (Introduction to Environmental Engineering) the instructor was asked to make sure to more fully address the societal implications of environmental pollution and other technology.

All numbers in the table are below our acceptance criterion of 2.25. In conclusion, we believe that the student surveys give us further evidence that we have met all our student outcomes.

**Student Outcomes - --Course-Based Assessment**

Course-based assessment is one method we use to assess achievement of student outcomes. This process relies on individual Course-Based Assessment Reports (CBARs) that are completed by course instructors for those courses in which student outcomes are assessed. Table 4.5 lists the specific engineering course(s) used for assessing each student outcome in the Civil Engineering program and the outcomes they assess. Numerous different metrics are used to assess outcomes. They include surveys, reports, homework problems, exam problems, proposals, projects, oral presentations, and papers. These are listed in Table 4.6. The Director of the School of Engineering maintains the raw data for these assessments.
| ENGR | Outcome | | Course | a | b | c | d | e | f | g | h | i | j | k |
|------|---------|---|------|---|---|---|---|---|---|---|---|---|---|
| 100  | f,h,i   |   | 100  | x | x | x |   |   |   |   |   |   |   |
| 200  | b       |   | 200  | x |   |   |   |   |   |   |   |   |   |
| 201  | a,e     |   | 201  | x |   | X |   |   |   |   |   |   |   |
| 302  | b,d,g,k |   | 302  | x | x | x | x | x |   |   |   |   |   |
| 304  | e       |   | 304  |   |   | X |   |   |   |   |   |   |   |
| 309  | a,e     |   | 309  | x |   | X |   |   |   |   |   |   |   |
| 323  | e,k     |   | 323  | X |   | x |   |   |   |   |   |   |   |
| 425  | c       |   | 425  | x |   |   |   |   |   |   |   |   |   |
| 429  | f,k     |   | 429  | x |   | x |   |   |   |   |   |   |   |
| 434  | h,i,j   |   | 434  | x | x | x | x |   |   |   |   |   |   |
| 696CE| f,g,i,j |   | 696CE| x | x | x | x | x |   |   |   |   |   |
| 697CE| c,d,g   |   | 697CE| x | x | x |   |   |   |   |   |   |   |

Table 4.5 Courses and outcomes for course-based assessment
<table>
<thead>
<tr>
<th>Course</th>
<th>Outcome</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>309 Mechanics</td>
<td>a</td>
<td>Final Exam</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>a</td>
<td>Quiz problem</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>a</td>
<td>Final Exam</td>
</tr>
<tr>
<td>200 Materials</td>
<td>b</td>
<td>Instructor survey</td>
</tr>
<tr>
<td>430 Soil Mech.</td>
<td>b</td>
<td>Student lab performance</td>
</tr>
<tr>
<td>200 Materials</td>
<td>b</td>
<td>Lab reports</td>
</tr>
<tr>
<td>302 Experiment.</td>
<td>b</td>
<td>OEP proposal</td>
</tr>
<tr>
<td>302 Experiment.</td>
<td>b</td>
<td>OEP report</td>
</tr>
<tr>
<td>697 Senior Project</td>
<td>c</td>
<td>Design project</td>
</tr>
<tr>
<td>425 Concrete design</td>
<td>c</td>
<td>HW3</td>
</tr>
<tr>
<td>425 Concrete design</td>
<td>c</td>
<td>HW6</td>
</tr>
<tr>
<td>425 Concrete design</td>
<td>c</td>
<td>Exam1</td>
</tr>
<tr>
<td>425 Concrete design</td>
<td>c</td>
<td>Exam2</td>
</tr>
<tr>
<td>697 Senior Project</td>
<td>d</td>
<td>Team functioning</td>
</tr>
<tr>
<td>302 Experiment.</td>
<td>d</td>
<td>Student survey</td>
</tr>
<tr>
<td>302 Experiment.</td>
<td>d</td>
<td>Student survey</td>
</tr>
<tr>
<td>697 Senior Project</td>
<td>d</td>
<td>Student survey Q2</td>
</tr>
<tr>
<td>697 Senior Project</td>
<td>d</td>
<td>Student survey Q3</td>
</tr>
<tr>
<td>697 Senior Project</td>
<td>d</td>
<td>Student survey Q4</td>
</tr>
<tr>
<td>201 Dynamics</td>
<td>e</td>
<td>Midterm</td>
</tr>
<tr>
<td>201 Dynamics</td>
<td>e</td>
<td>Final</td>
</tr>
<tr>
<td>201 Dynamics</td>
<td>e</td>
<td>Midterm 1</td>
</tr>
<tr>
<td>201 Dynamics</td>
<td>e</td>
<td>Final</td>
</tr>
<tr>
<td>304 Fluid Mechanics</td>
<td>e</td>
<td>Test1 P2</td>
</tr>
<tr>
<td>304 Fluid Mechanics</td>
<td>e</td>
<td>Test1 P1</td>
</tr>
<tr>
<td>304 Fluid Mechanics</td>
<td>e</td>
<td>Test2 P1</td>
</tr>
<tr>
<td>304 Fluid Mechanics</td>
<td>e</td>
<td>Test2 P3</td>
</tr>
<tr>
<td>304 Fluid Mechanics</td>
<td>e</td>
<td>Final P2</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>e</td>
<td>Quiz 10/7</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>e</td>
<td>Quiz 10/14</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>e</td>
<td>Final exam</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>e</td>
<td>Quiz 3/24</td>
</tr>
<tr>
<td>309 Mechanics</td>
<td>e</td>
<td>Quiz 11/18</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Method</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>309</td>
<td>Mechanics</td>
<td>e</td>
</tr>
<tr>
<td>309</td>
<td>Mechanics</td>
<td>e</td>
</tr>
<tr>
<td>309</td>
<td>Mechanics</td>
<td>e</td>
</tr>
<tr>
<td>309</td>
<td>Mechanics</td>
<td>e</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>f</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>f</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>f</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>f</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>f</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>f</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>g</td>
</tr>
<tr>
<td>302</td>
<td>Experiment.</td>
<td>g</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>g</td>
</tr>
<tr>
<td>697</td>
<td>Senior Project</td>
<td>g</td>
</tr>
<tr>
<td>302</td>
<td>Experiment.</td>
<td>g</td>
</tr>
<tr>
<td>100</td>
<td>Intro to Engineering</td>
<td>h</td>
</tr>
<tr>
<td>434</td>
<td>Intro to Environment Engin.</td>
<td>h</td>
</tr>
<tr>
<td>100</td>
<td>Intro to Engineering</td>
<td>h</td>
</tr>
<tr>
<td>434</td>
<td>Intro to Environment Engin.</td>
<td>i</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>i</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>i</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>j</td>
</tr>
<tr>
<td>434</td>
<td>Intro to Environment Engin.</td>
<td>j</td>
</tr>
<tr>
<td>696</td>
<td>Senior Project</td>
<td>j</td>
</tr>
<tr>
<td>302</td>
<td>Experiment.</td>
<td>j</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>k</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>k</td>
</tr>
<tr>
<td>429</td>
<td>Construct. Manage.</td>
<td>k</td>
</tr>
</tbody>
</table>

Table 4.6 Metric used to assess the attainment for each outcome.

For each course that has been chosen for outcomes assessment, the Outcomes Assessment Committee works with the appropriate faculty to prepare a CBAR (Course Based Assessment Report). Sample CBARs for lecture courses, laboratory courses and the capstone senior project courses are included in Appendix E.
To describe the process, we use ENGR 304 (Mechanics of Fluids) as an example. ENGR 304 is one of the courses used to assess outcome (e): an ability to identify, formulate, and solve engineering problems.

Each CBAR starts with a summary of the outcomes that are being assessed in the particular course. The CBAR lists the performance criteria that have been chosen for measurement and the metrics that are used to measure these criteria.

For ENGR 304, the performance criteria and metrics selected to correspond to outcome (e) are shown in the following table.

<table>
<thead>
<tr>
<th>Performance Criterion</th>
<th>Metric</th>
<th>Acceptance Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student is able to correctly apply the equations of hydrostatics to solve problems related to hydrostatic pressure variation and buoyancy.</td>
<td>Selected exam problem(s)</td>
<td>Average score ≥ 70%</td>
</tr>
<tr>
<td>Student is able to correctly use the Bernoulli Equation solve for the pressure and/or velocity at a point in a flow field.</td>
<td>Selected exam problem(s)</td>
<td>Average score ≥ 70%</td>
</tr>
<tr>
<td>Student has an understanding of the momentum equation and can apply it correctly to solve fluid flow problems.</td>
<td>Selected exam problem(s)</td>
<td>Average score ≥ 70%</td>
</tr>
<tr>
<td>Student is able to formulate and solve problems using dimensional analysis.</td>
<td>Selected exam problem(s)</td>
<td>Average score ≥ 70%</td>
</tr>
<tr>
<td>Student is able use both theoretical and empirical relations to solve for drag and lift forces acting on a body.</td>
<td>Selected exam problem(s)</td>
<td>Average score ≥ 70%</td>
</tr>
</tbody>
</table>

Table 4.7 Performance criteria, metrics, and acceptance criteria for course-based assessment of outcome (e) in ENGR 304: Mechanics of Fluids.

Across all CBARs, metrics include grades on selected exam problems, homework problems, laboratory exercises, term projects, and presentations. They also include data from rubrics which allow the instructor to quantitatively assess things such as the organization of an oral presentation on a 1 to 3 scale (1 = “exemplary,” 2 = “acceptable,” 3 = “unacceptable”). Instructors tabulate and normalize data for each performance criterion and compare the result to the School’s acceptance criterion, which has been established by the Outcome Assessment Committee and the School’s Director (acceptance criteria for the ENGR 304 metrics are also
provided in Table 4.7). For most numerical data, especially individual exam or homework problems, the acceptance criteria corresponds to a certain score (typically around 70%) determined by the instructor as representing a satisfactory level of proficiency in the outcome. For data from the three-level rubrics, the acceptance criteria are reached when the average score of the students is 2 or better (lower).

The results of all the course based assessments are presented in Figs 4.3 to 4.13.
Figure 4.3: CBA results for assessment of outcome (a)
Figure 4.4: CBA results for assessment of outcome (b)
Figure 4.5: CBA results for assessment of outcome (c)

Figure 4.6: CBA results for assessment of outcome (d)
Figure 4.7: CBA results for assessment of outcome (e)
Figure 4.8: CBA results for assessment of outcome (f)
Figure 4.9: CBA results for assessment of outcome (g)

Figure 4.10: CBA results for assessment of outcome (h)
Figure 4.11: CBA results for assessment of outcome (i)

Figure 4.12: CBA results for assessment of outcome (j)
By almost all metrics, the CBARs have given evidence that all outcomes have been met. The failed metrics are shown in red in Figs. 4.3 to 4.13. The following comments are made with respect to each outcome:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Five of six metrics indicate that the outcome was met, while the sixth metric barely failed. Conclusion: outcome met.</td>
</tr>
<tr>
<td>b</td>
<td>All metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
<tr>
<td>c</td>
<td>All metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
<tr>
<td>d</td>
<td>All metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
<tr>
<td>e</td>
<td>Nine of ten metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
<tr>
<td>f</td>
<td>Three of four metrics indicate that the outcome was met. On speaking with the instructor of the unmet metric, it is believed that the outcome was met although this will be retested in the next cycle. Conclusion: outcome met.</td>
</tr>
<tr>
<td>g</td>
<td>All metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
<tr>
<td>h</td>
<td>All metrics indicate that the outcome was met. Conclusion: outcome met.</td>
</tr>
</tbody>
</table>
| i       | One of two metrics indicate that the outcome was met. For the failed metric, too many students did not attend all the required seminars. On speaking to the
instructor, it was determined that all students attended at least two seminars but some did not attend the required three seminars. So it is believed that this outcome was met, but the instructor will take corrective action by increasing the penalty for not attending all three seminars. Conclusion: outcome met but future corrective action will be taken.

j Two of three metrics indicate that the outcome was met. Again, the instructor will take corrective action by increasing the penalty for not attending all three seminars. Conclusion: outcome met but future corrective action will be taken.

h All metrics indicate that the outcome was met. Conclusion: outcome met.

B. Continuous Improvement

Continuous Improvement - Improvements based on Alumni surveys.

The alumni surveys were described previously and presented as evidence that we have met all our outcomes and objectives. However, the surveys included a portion on how the Civil Engineering Program could be improved. We have used these surveys to help us improve our program. Alumni made a number of different comments but some were made more than once and these are the ones we have acted upon. They are:

1. Need for improved laboratories.

2. Need for improvement in software instruction (including specialty software).

It appears that while students feel that although they have learned how to use software and instrumentation well (meeting our objectives and outcomes), the computer and laboratory facilities could be improved to make their learning easier and more complete. The program has been working hard to address these issues. The School of Engineering has received an annual equipment fund around $50,000 from the College of Science and Engineering to upgrade our equipment every year. Faculty are asked to submit their plan for the equipment fund in late January every year. The Director then summarizes and prioritizes the request before it is submitted to the Dean’s office by late March. The funding level for equipment is appropriate and satisfactory to keep our equipment for teaching current.

The actions listed here have been taken since 2011:

1. The following laboratory equipment has been added or upgraded and integrated into laboratory instruction:

   a. Constant head permeability testing equipment. (ENGR 430, 696, 697)
   b. New soil direct shear strength testing device. (ENGR 430, 696, 697)
c. Addition of Hilton Instruction models for use in ENGR 323 (Structural Analysis)
d. Addition of 3 GPS TOPCON GR-3 systems for use in ENGR 235 (Surveying)
e. Addition of a National Instrument Data Acquisition system for use in ENGR 300 (Engineering Experimentation)
f. Addition of 4 Synology NAS 412+ desktop computers for use in ENGR 696 and 697 (Engineering Design Project I and II)

2. The following equipment and laboratory space has been upgraded and more integrated into instruction:

   a. Structural seismic shake table. (ENGR 696, 697)
   b. Structural Computational Lab (ENGR 696, 697, 699)
   c. Advanced Material Research Lab (ENGR 699)
   d. Structural Laboratory for Multiple Hazard Mitigation (ENGR 699)

3. The following software has been more integrated into instruction:

   a. SAP2000 structural analysis with a gift of 50 full licenses from the company CSI. (ENGR 696, 697)
   b. ETABS structural analysis. (ENGR 323, 696, 697)
   c. RISA-3D structural analysis and design (ENGR 323, 425, 426, 427)
   d. Excel spreadsheet analysis. (ENGR 430, 431, 696, 697)
   e. 30 full licenses of the S-Frame Suites - software that are widely used in design of concrete and steel structures.

Continuous Improvement - Improvements based on results from student surveys

   a. New equipment purchased for the labs. This has been described elsewhere and will not be repeated here.
   b. To provide students the opportunity to learn and work on commercial software that is widely used in professional practice, faculty members in School of Engineering are actively working to gain access to programs for students. Through the generosity of S-Frame Software Inc., San Francisco State University received 30 full licenses of the S-Frame Suites - software that are widely used in design of concrete and steel structures. Also, 50 full licenses SAP2000 were generously awarded by CSI to our program. This program has been used extensively in our student projects.
   c. We have instituted a better transfer student advising procedure. We now require transfer students to meet individually with the Civil Engineering program head during their first semester at SFSU. Transfer courses are approved or rejected and the student knows immediately the requirements to complete the degree. This has been found to be very
effective in improving the ability of transfer students to complete a civil engineering degree.

d. We have improved our communication with students by creating a web calendar so that students can easily see all our events in one place.
e. We have created an electronic suggestion box so that students can offer improvements at any time.

**Continuous Improvement - Improvements based on Course Based Assessment.**

Our courses have been evaluated using our Course Based Assessment Reports. In addition, every course is evaluated by students. Corrective actions resulting from these evaluations are listed here:

a. CBAR action: As described previously, a harsher penalty will be given to students not attending three seminars.
b. CBAR action: Retesting of outcome f will take place and if it fails again, corrective action will be taken.
c. Student evaluation action: Early uploading of course slides for ENGR 425 (Concrete Structures)
d. Student evaluation action: More examples provided as supplemental materials for ENGR 309 (Mechanics of Solids)
e. Student evaluation action: Prepared MatLab tutorials as supplemental materials for ENGR 829 (Advanced Topics in Structural Engineering).
f. Student evaluation action: Used colored marker presentations in ENGR 309 (Mechanics of Solids)
g. Student evaluation action: Provided an increased variety of examples and discussion problems for ENGR 102 (Statics)
h. Student evaluation action: Changed the textbook for ENGR 102 (Statics).
i. Student evaluation action: Utilized discussion times and homework to gauge areas where more time is needed to cover the subject in ENGR 102 (Statics).
j. Student evaluation action: Used questions and discussion to gauge the pace of each subject matter adjusting when needed in ENGR 426 (Steel Structures).
k. Student evaluation action: Added more practical problems to homework sets in ENGR 426 (Steel Structures).
Continuous Improvement - Improvements based on other available information.

“Other available information” has a number of sources, many of them informal to supplement the formal sources of input listed for Criteria 2 and 3. We rely on faculty experience, input from the director of the School of Engineering and other university administrators, informal conversations with students and alumni, and discussions with members of industry. The following improvements based on these sources have been made since our last accreditation:

1. We have hired two new tenure-track faculty in Civil Engineering, Dr. Zhaoshuo Jiang and Dr. Jenna Wong.
2. We initialized a San Francisco State University student chapter of the Earthquake Engineering Research Institute (EERI). Part of the reason we began this student chapter is that our students have been regularly participating in the EERI seismic design competition.
3. We have put increased emphasis on ASCE and EERI civil engineering competitions. We have made an effort to give students more funding and resources. The effort has been quite successful as we have placed nationally in both the ASCE timber bridge and the EERI seismic competition. Our students have placed the following in the nation:
   a. EERI 2012 National Seismic Design Competition – national 20th place finish Overall
   b. EERI 2013 National Seismic Design Competition – national 18th place finish Overall
   c. EERI 2014 National Seismic Design Competition – national 28th place finish Overall
   d. EERI 2016 National Seismic Design Competition – national 3rd place finish Proposal, national 9th place finish Overall
   e. EERI 2017 National Seismic Design Competition – national 1st place finish Best Seismic Performance, national 23rd place finish Overall
   f. Timber Bridge 2013 - national 1st place Most Innovative Design, 1st place Most Aesthetic Design, 2nd place Best Overall Design
   g. Timber Bridge 2014 - national 1st place Most Innovative Design, 1st place Most Aesthetic Design
   h. Timber Bridge 2015 - national 1st place Most Innovative Design, 1st place Most Aesthetic Design
   i. Timber Bridge 2016 - national 3rd place Most Aesthetic Design

We are especially proud of our students’ performance in these competitions. In the EERI seismic competition, our students have beaten top colleges in engineering. Our 2017 “Best Seismic Performance” national first place beat the following top engineering
universities: UC Berkeley, Stanford University, Purdue University, UC San Diego, Cornell University, UCLA, USC, University of British Columbia, University of Texas, Virginia Tech, Rice University, University of Colorado, Lehigh University, Cal Poly San Luis Obispo, and others. Our 2016 national ninth place overall beat many of the same schools as well as the University of Michigan and the University of Illinois.

In the Timber Bridge competition, we routinely do quite well. Teams we have beaten include University of Missouri, Ohio State University, Oklahoma State University, Mississippi State University, Oregon State University, Temple University, and others.

4. The high performance on the national competitions has led to winning awards at our student competition in the SFSU College of Science and Engineering (called COSE showcase). This event is a competition among all the departments in the college including biology, physics, computer science, math, chemistry, earth sciences and others. Civil engineering student teams and undergraduate independent research projects have won the following in recent years:
   a. 2014 – Second place (Roll Up Timber Bridge)
   b. 2014 – Fourth place (Reliability Assessment of Real-Time Hybrid Simulation for Time-Delayed MDOF Structures)
   c. 2016 – Second place (Interactive Remote Shake Table Laboratory for Instruction in Earthquake Engineering)
   d. 2016 – Fourth place (EERI Seismic Design Team)

5. A faculty member received an MRI grant to acquire state-of-the-art servo-hydraulic equipment for earthquake engineering research and education.

6. A faculty member received a NSF-BRIGE grant to explore probabilistic reliability assessment of real-time hybrid simulation results in the presence of actuator delay. Over 3 years, 20 undergraduate and graduate students participated. About 80% of the undergraduate students who participated went to graduate school afterward.

7. We were able to obtain new facilities for our newly hired assistant professors.

8. We have expanded a summer program for high school students. The summer engineering institute is funded by the Department of Education through its Minority Science and Engineering Improvement Program (MSEIP). The SEI program has attracted many high school students and transfer students in Civil Engineering program at our School.

9. We have increased the number of tutoring hours and Science courses that aim to improve our retention in engineering.

10. We have created discussion sessions with the School of Engineering Student Advisory Board. The purpose of these was to solicit input directly from student leaders regarding how the school could be improved. Student leaders from the ESAB are invited to two School meetings each semester to express what student’s suggestions on curriculum improvement and how faculty can help students to succeed and excel. One faculty
advisor is assigned to meet with the ESAB every month as the faculty liaison to communicate with the Director.

11. We continually work to improve student advising by faculty. We had previously found that new transfer students were not coming to faculty for advising during their first semester. We felt it was important to give them advising almost immediately upon entering our program. We instituted a system of repeated emails to transfer students indicating that they were required to see the program head to approve transfer units. This methodology has been quite effective in getting transfer students advised effectively.

12. We have improved our alumni outreach by more effectively promoting our annual alumni barbeque. The result is that attendance by alumni has increased substantially. This effort has helped us with return rates on alumni surveys and alumni informal input to the quality of the program.

13. We have improved our outreach to high school and community college students. The Director has attended monthly meetings to discuss how to revise the transfer patterns and articulation process with the local community college faculty since January 2009. Faculty members have been active in participating in the outreach events. Our annual Sneak Preview has attracted overwhelming interest and has now been relocated to a bigger room to accommodate a bigger crowd.

14. Students in ENGR 696/697 have been awarded through the Instructionally Related Activities (IRA) fund to support their design projects. For example, students received over $12000 this academic year for their projects.

15. We have made a number of curriculum improvements which are described in Criterion 5.

16. We have offered two sections of Engr 102 (Statics), 201 (Dynamics), 304 (Fluid Mechanics), and 309 (Mechanics of Solids) every semester due to the availability of increased funding.

17. We have offered many summer courses since 2013 to help students graduate on time.

18. We have reduced class size by offering Engr 429 (Construction Engineering), Engr 434 (Environmental Engineering), and 235 (Surveying) every semester.

19. We have created a student chapter of SASE (Society of Asian Scientists and Engineers) which has been active in offering Fundamentals of Engineering exam test preparation, resume workshops and field trips.

20. We have received funding support ($129,000) from Quanser Inc., a leading structural control company in research/education, for the purpose of developing a mobile remote shake table laboratory. This provides opportunities for students to participate and conduct hands-on experiments through portable devices such as smart phones and tablets.

21. A greater emphasis was put on lab safety. Although, we have not experienced any incidents, we increased our use of the college safety director.

22. Faculty members in the School of Engineering are actively engaged in improving students’ learning experience by adopting new technologies. One of our faculty members was funded by the CSU Chancellor’s Office a Course Redesign with Technology Grant
to develop interactive mobile apps and course review videos for an undergraduate level Mechanics of Solids course to engage students and increase their self-efficacy.

23. Through the Cañada College and San Francisco State University Cooperative Minority Science and Engineering Improvement Program (MSEIP), two of our faculty members mentor eight undergraduate students each summer on topics in earthquake engineering research.

24. Two faculty were awarded Affordable Instructional Materials (AIM) grants. These projects are supported by funding from the CSU Chancellor’s Office to expand campus efforts to reduce the cost of learning for students, as part of the “Affordable Learning Solutions” initiative.

25. Addition of Hilton Instruction models for use in ENGR 323 (Structural Analysis)
26. Addition of 3 GPS TOPCON GR-3 systems for use in ENGR 235 (Surveying)
27. Addition of a National Instrument Data Acquisition system for use in ENGR 300 (Engineering Experimentation)
28. Addition of 4 Synology NAS 412+ desktop computers for use in ENGR 696 and 697 (Engineering Design Project I and II)
29. Our new emphasis on undergraduate research has led to a first place in the CSU undergraduate research competition for his work on “The Mobile Remote Shake Table Laboratory”, advised by Dr. Zhaoshuo Jiang.
30. Planning for the design and construction of a new building housing the School of Engineering has begun

**Continuous Improvement – Reassessment results**

As stated previously, we continuously improve our program and continuously reassess. The best we can do is show improvement because we never say we are completely satisfied. For reference, Table 4.7 is repeated here:

Table 4.7 Student exit survey results

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. I have learned to work with others on group projects.</td>
<td>d</td>
<td>1.71</td>
<td>1.33</td>
<td>1.45</td>
</tr>
<tr>
<td>6. I am comfortable dealing with others whose training and expertise are different from my own.</td>
<td>d</td>
<td>1.82</td>
<td>1.41</td>
<td>1.61</td>
</tr>
<tr>
<td>7. I am comfortable speaking in front of a group of my peers</td>
<td>g</td>
<td>2.07</td>
<td>1.56</td>
<td>2.1</td>
</tr>
<tr>
<td>8. I have learned to make effective</td>
<td>g</td>
<td>1.98</td>
<td>1.67</td>
<td>1.96</td>
</tr>
<tr>
<td>Presentations to Peers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I have learned to communicate effectively in writing</td>
<td>g</td>
<td>2</td>
<td>1.73</td>
<td>1.86</td>
</tr>
<tr>
<td>10. I have learned to analyze and design systems, components or processes in my field.</td>
<td>a, b, c, e, k</td>
<td>2.14</td>
<td>1.62</td>
<td>1.69</td>
</tr>
<tr>
<td>11. I have learned to use computers to solve engineering problems.</td>
<td>a, b, c, e, k</td>
<td>2.07</td>
<td>2.19</td>
<td>1.91</td>
</tr>
<tr>
<td>12. I have the foundation for learning new information and procedures.</td>
<td>i</td>
<td>1.79</td>
<td>1.53</td>
<td>1.65</td>
</tr>
<tr>
<td>13. I have gained an awareness of the impact of engineering activities in a global and societal context.</td>
<td>h, j, f</td>
<td>2</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>14. I have gained an awareness of how some contemporary issues are related to engineering.</td>
<td>j</td>
<td>2.02</td>
<td>1.79</td>
<td>1.54</td>
</tr>
<tr>
<td>15. I understand my professional and ethical responsibilities as an engineer</td>
<td>f</td>
<td>1.63</td>
<td>1.35</td>
<td>1.45</td>
</tr>
<tr>
<td>16. I am aware that I will need to continue learning new information and methods in my professional career.</td>
<td>i</td>
<td>1.54</td>
<td>1.38</td>
<td>1.41</td>
</tr>
<tr>
<td>17. My senior project was a valuable part of my educational experience.</td>
<td>b, c</td>
<td>1.61</td>
<td>1.44</td>
<td>1.53</td>
</tr>
<tr>
<td>18. I am well prepared to enter my chosen field.</td>
<td>c, k</td>
<td>2</td>
<td>1.94</td>
<td>1.82</td>
</tr>
</tbody>
</table>

From this table it can be seen that we have improved from 2013 in a number of areas. The greatest improvements are in the areas of:

- Teamwork (5 and 6 in Table 4.7)
- Design (10 in Table 4.7),
- Computer work (11 in Table 4.7),
- Social issues (13, 14, and 15 in Table 4.7)
- Lifelong learning (16 in Table 4.7).

While we have improved, we recognize that we can still improve more in all these areas.

**C. Additional Information**

Copies of the assessment instruments and materials are available for review at the time of the visit.
CRITERION 5: CURRICULUM

A. Program Curriculum

For reference, the ABET criterion is:

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.

A.1  Plan of Study

The Civil Engineering curriculum at SFSU is based on the semester system. Table 5.1 shows the plan of study for students in our Civil Engineering program including information on course offerings semester and average section enrollments for all courses in the program.
<table>
<thead>
<tr>
<th>Course (Department, Number, Title)</th>
<th>Indicate Whether Course is Required, Elective or a Selected Elective by an R, an E or an SE</th>
<th>Subject Area (Credit Hours)</th>
<th>Engineering Topics Check if Contains Significant Design (√)</th>
<th>General Education</th>
<th>Other</th>
<th>Last Two Terms the Course was Offered: Year and, Semester, or Quarter</th>
<th>Average Section Enrollment for the Last Two Terms the Course was Offered¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Semester</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 180, Chemistry for Energy and the Environment</td>
<td>R</td>
<td>3</td>
<td></td>
<td></td>
<td>F16 / S17</td>
<td>26/26</td>
<td></td>
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<tr>
<td>MATH 226, Calculus I</td>
<td>R</td>
<td>4</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td>34/38</td>
<td></td>
</tr>
<tr>
<td>ENGR 100, Introduction to Engineering</td>
<td>R</td>
<td>1</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td>140/90</td>
<td></td>
</tr>
<tr>
<td>ENGR 101, Engineering Graphics</td>
<td>R</td>
<td>1</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td>28/32</td>
<td></td>
</tr>
<tr>
<td>ENG 114, 1st Yr. Written Composition</td>
<td>R</td>
<td>3</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td>24/22</td>
<td></td>
</tr>
<tr>
<td>U.S. History or Government</td>
<td>SE</td>
<td>3</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Second Semester</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 227, Calculus II</td>
<td>R</td>
<td>4</td>
<td></td>
<td></td>
<td>F10 / S11</td>
<td>40/43</td>
<td></td>
</tr>
<tr>
<td>PHYS 220 Physics I</td>
<td>R</td>
<td>3</td>
<td></td>
<td></td>
<td>F10 / S11</td>
<td>113/100</td>
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<tr>
<td>PHYS 222 Physics I Lab</td>
<td>R</td>
<td>1</td>
<td></td>
<td></td>
<td>F16/S17</td>
<td>26/23</td>
<td></td>
</tr>
<tr>
<td>Course</td>
<td>Credits</td>
<td>Term</td>
<td>Hrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGR 103, Introduction to Computers</td>
<td>R</td>
<td>1</td>
<td>F16/S17 23/31</td>
<td></td>
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<tr>
<td>Oral Communications</td>
<td>R</td>
<td>3</td>
<td>F16/S17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Education Elective</td>
<td>SE</td>
<td>3</td>
<td>F16/S17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Third semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Term</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 228, Calculus III</td>
<td>R</td>
<td>4</td>
<td>F16/S17 45/43</td>
</tr>
<tr>
<td>PHYS 230, Physics II</td>
<td>R</td>
<td>3</td>
<td>F16/S17 96/99</td>
</tr>
<tr>
<td>PHYS 232, Physics II Lab</td>
<td>R</td>
<td>1</td>
<td>F16/S17 30/24</td>
</tr>
<tr>
<td>ENGR 102, Statics</td>
<td>R</td>
<td>3</td>
<td>F16/S17 54/29</td>
</tr>
<tr>
<td>ENGR 235, Surveying</td>
<td>R</td>
<td>3</td>
<td>F16/S17 16/15</td>
</tr>
<tr>
<td>ENG 214, 2nd Yr. Written Composition</td>
<td>R</td>
<td>3</td>
<td>F16/S17 25/25</td>
</tr>
</tbody>
</table>

**Fourth semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Term</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 245, Diff. Equations &amp; Lin. Algebra</td>
<td>R</td>
<td>3</td>
<td>F16/S17 36/32</td>
</tr>
<tr>
<td>PHYS 240 Phys III</td>
<td>R</td>
<td>3</td>
<td>F16/S17 30/76</td>
</tr>
<tr>
<td>PHYS 242, Physics III Lab</td>
<td>R</td>
<td>1</td>
<td>F16/S17 30/24</td>
</tr>
<tr>
<td>ENGR 200, Materials of Engineering</td>
<td>R</td>
<td>3</td>
<td>F16/S17 19/20</td>
</tr>
<tr>
<td>ENGR 201, Dynamics</td>
<td>R</td>
<td>3</td>
<td>F16/S17 61/29</td>
</tr>
<tr>
<td>ENGR 205, Electric Circuits</td>
<td>R</td>
<td>3</td>
<td>F16/S17 54/59</td>
</tr>
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<td>Semester</td>
<td>Course Code</td>
<td>Course Name</td>
<td>Credits</td>
</tr>
<tr>
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<td>-------------</td>
<td>-------------------------------------------------</td>
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</tr>
<tr>
<td>Fifth semester</td>
<td>ENGR 300</td>
<td>Engineering Experimentation</td>
<td>R</td>
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<tr>
<td></td>
<td>ENGR 304</td>
<td>Mechanics of Fluids</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 309</td>
<td>Mechanics of Solids</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 434</td>
<td>Principle of Environmental ENGR.</td>
<td>R</td>
</tr>
<tr>
<td>General Education Electives</td>
<td>SE</td>
<td>3 (Life science)</td>
<td>SE</td>
</tr>
<tr>
<td>Sixth semester</td>
<td>ENGR 302</td>
<td>Experimental Analysis</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 323</td>
<td>Structural Analysis</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 429</td>
<td>Construction Management</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 430</td>
<td>Soil Mechanics</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>ENGR 436</td>
<td>Transportation Engineering</td>
<td>R</td>
</tr>
<tr>
<td>General Education Elective</td>
<td>SE</td>
<td>3</td>
<td>SE</td>
</tr>
<tr>
<td>Seventh semester</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Engineering Electives</td>
<td>SE</td>
<td>6</td>
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</tr>
<tr>
<td>ENGR 696, Engineering Design Project I</td>
<td>R</td>
<td>1(√)</td>
<td></td>
</tr>
<tr>
<td>ENGR 425, Reinforced Concrete Structures</td>
<td>R</td>
<td>3(√)</td>
<td></td>
</tr>
<tr>
<td>General Education Elective</td>
<td>SE</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Eighth semester</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering electives</td>
<td>SE</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ENGR 697, Engineering Design Project II</td>
<td>R</td>
<td>2(√)</td>
<td></td>
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<tr>
<td>General Education Elective</td>
<td>SE</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Engineering electives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGR 303, Engineering Thermodynamics</td>
<td>E</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENGR 426 Steel Structures</td>
<td>E</td>
<td>3(√)</td>
<td></td>
</tr>
<tr>
<td>ENGR 427, Wood Structures</td>
<td>E</td>
<td>3(√)</td>
<td></td>
</tr>
<tr>
<td>ENGR 431, Foundation Engineering</td>
<td>E</td>
<td>3(√)</td>
<td></td>
</tr>
<tr>
<td>ENGR 432, Finite Element Methods</td>
<td>E</td>
<td>3(√)</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Division</td>
<td>Credits (LAB)</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------</td>
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<tr>
<td>ENGR 435</td>
<td>Environment Engineering Design</td>
<td>E</td>
<td>3(\sqrt{3})</td>
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<tr>
<td>ENGR 439</td>
<td>Construction Engineering</td>
<td>E</td>
<td>3(\sqrt{3})</td>
</tr>
<tr>
<td>ENGR 441</td>
<td>Fundamentals of Composite Materials</td>
<td>E</td>
<td>3(\sqrt{3})</td>
</tr>
<tr>
<td>ENGR 461</td>
<td>Mechanical and Structural Vibrations</td>
<td>E</td>
<td>3(\sqrt{3})</td>
</tr>
<tr>
<td>ENGR 468</td>
<td>Applied Fluid Mechanics and Hydraulics</td>
<td>E</td>
<td>3(\sqrt{3})</td>
</tr>
<tr>
<td>ENGR 469</td>
<td>Alternative and Renewable Energy Systems</td>
<td>E</td>
<td>3</td>
</tr>
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<td>ENGR 610</td>
<td>Engineering Cost Analysis</td>
<td>E</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Section</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>ENGR 825</td>
<td>Bridge Engineering and Prestressed Reinforced Concrete Structures</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 826</td>
<td>Seismic Hazard Analysis</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 827</td>
<td>Structural Design for Fire Safety</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 828</td>
<td>Seismic Isolation and Energy Dissipation</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 829</td>
<td>Advanced Topics in Structural Engineering</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 830</td>
<td>Finite Element Methods in Structural Continuum Mechanics</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 831</td>
<td>Advanced Concrete Structures</td>
<td>E</td>
<td>3(3)</td>
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<td>ENGR 832</td>
<td>Advanced Topics in Seismic Design</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 833</td>
<td>Principles of Earthquake Engineering</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>ENGR 835</td>
<td>Advanced</td>
<td>E</td>
<td>3(3)</td>
</tr>
<tr>
<td>Steel Structures</td>
<td>E</td>
<td>3(√)</td>
<td>S16</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>----</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>ENGR 836, Structural Design for Earthquakes</td>
<td>E</td>
<td>3(√)</td>
<td>S16</td>
</tr>
<tr>
<td>ENGR 837, Geotechnical Earthquake Engineering</td>
<td>E</td>
<td>3(√)</td>
<td>S16</td>
</tr>
</tbody>
</table>

**TOTALS-ABET BASIC-LEVEL REQUIREMENTS**

| OVERALL TOTAL CREDIT HOURS FOR THE DEGREE | 33 | 61 | 33 | 0 |

**PERCENT OF TOTAL**

<table>
<thead>
<tr>
<th>Total must satisfy either credit hours or percentage</th>
<th>Minimum Semester Credit Hours</th>
<th>32 Hours</th>
<th>48 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Percentage</td>
<td>25%</td>
<td>37.5%</td>
<td></td>
</tr>
</tbody>
</table>
We offer four focus areas:

- Structural Engineering
- Geotechnical Engineering
- Environmental Engineering
- Construction Management

All students acquire an ability to apply knowledge in all four areas. However, the degree that we offer is a general civil engineering degree. After graduating, students can practice (and graduates have practiced) in any of the areas. We do not require them to choose a focus area (in which they can take additional courses to suit their interests). We do advise them on how they can achieve extra relevant knowledge in each of the focus areas through a selection of their engineering electives. But to obtain the degree, they do not need to follow a focus area path. They need only meet the required engineering design units in their engineering electives. As a result, there is no focus-area-specific course list in the format of Table 5.1

A.2 How the curriculum aligns with the program educational objectives.

The Civil Engineering Program of the School of Engineering has the following educational objectives:

Graduates of the civil engineering program are expected to have, within a few years of graduation:

1. Established themselves as practicing professionals or engaged in graduate study in civil engineering or a related field.
2. Become licensed civil engineers or made appropriate progress toward professional registration.

The curriculum is set up to achieve the program objectives. To achieve our objectives, students must have a sufficient background in analysis and design, communications, teamwork, economics, environmental and social, ethics, lifelong learning, professional certification, and professional societies. Each of these is addressed next.

Analysis and Design – We have developed and evaluated each engineering course so that we determine the portion of the course containing engineering science (primarily in the form of analysis) and engineering design. For instance, our Mechanics of Fluids course (ENGR 304) has 3 semester units total. Of those 3 units, 2 units consist of engineering science and 1 unit consists of engineering design. The division between science and design for all civil engineering courses is presented in Table 5-2.
### Table 5-2 Engineering Science and Design units for all Civil Engineering courses

<table>
<thead>
<tr>
<th>Course number</th>
<th>Course name</th>
<th>Total number of units</th>
<th>Engineering science units</th>
<th>Engineering design units</th>
</tr>
</thead>
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<td>Required courses</td>
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<td></td>
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<tr>
<td>100</td>
<td>Introduction to Engineering</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>101</td>
<td>Engineering Graphics</td>
<td>1</td>
<td>1</td>
<td>0</td>
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<tr>
<td>102</td>
<td>Statics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>103</td>
<td>Introduction to Computers (Lab)</td>
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<td>235</td>
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<td>2</td>
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<td>2.5</td>
<td>0.5</td>
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<td>434</td>
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<td>2</td>
<td>1</td>
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<td>436</td>
<td>Transportation Engineering</td>
<td>3</td>
<td>1.5</td>
<td>1.5</td>
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<td>696</td>
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<td>1</td>
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<td>1</td>
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<td>697</td>
<td>Engineering Design Project II</td>
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<td>2</td>
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<td>Elective courses</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>0</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>426</td>
<td>Steel Structures</td>
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<td>0</td>
<td>3</td>
</tr>
<tr>
<td>427</td>
<td>Wood Structures</td>
<td>3</td>
<td>0</td>
<td>3</td>
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<td>428</td>
<td>Applied Stress Analysis</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td>431</td>
<td>Foundation Engineering</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>432</td>
<td>Finite Element Methods</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>435</td>
<td>Environmental Engineering Design</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>439</td>
<td>Construction Engineering</td>
<td>3</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>441</td>
<td>Fundamentals of Composite</td>
<td>3</td>
<td>2.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
From Table 5-2, it can be seen that in the required courses there are 33 engineering science units and 15 engineering design units. In the elective courses, students are required to have at least 3.5 units of engineering design (of a total of 12 units). This means that a student meeting the minimum number of design units has a total of 18.5 units of design and 41.5 units of science. Most students take more design units so that a typical student has at least 20 units of design and about 40 units of science. This results in a ratio of about 2 units of science for each unit of design. We believe that this proportion is about right to give students an adequate background in both analysis and design. Details of the course contents can be found in the course syllabi given in the Appendix A.

In summary, analysis is done throughout the engineering curriculum, from the beginning (after the introductory course, ENGR 100, Introduction to Engineering) to the last high level courses. Civil engineering design begins in the 300 level courses but is not heavily done until the 400 level courses. This is natural because an adequate background in analysis is necessary before design can be done.

Both analysis and design are taught through lectures, exams, homework assignments, laboratory experiments, and projects. The details are given in the outcome assessment. Design projects are central to the teaching of design in our program. A number of required courses (ENGR 300, 302, 304, and 430) have assigned design projects or projects in which experiments are designed. The senior project courses ENGR 696 and 697 have major team design projects.

**Communication** – Basic written and oral communication are covered in the general education portion of students’ curriculum. All students are required to take two classes in written English (ENG 114 and 214 or equivalent) and one class in oral communication (Speech 150 or
equivalent). In addition, students must complete the Graduation Writing Assessment Requirement (GWAR) course sequence which consists of Engr 300, 302, 696, and 697.

Scientific communication is taught in Chemistry (1 course) and Physics (3 courses) in the laboratory portion of the classes. Students are required to write lab reports describing their experiments in these subjects.

Engineering communication is taught throughout the engineering curriculum. It begins in ENGR 100 and continues into the students’ final semester in their senior project. Table 5.3 lists the courses and methods of teaching engineering communication (for required courses).

Table 5-3 Courses and methods of teaching engineering communication (for required courses).

<table>
<thead>
<tr>
<th>Course number</th>
<th>Course name</th>
<th>Method of Engineering communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 100</td>
<td>Introduction to Engineering</td>
<td>Oral presentations, written reports</td>
</tr>
<tr>
<td>ENGR 101</td>
<td>Engineering graphics</td>
<td>Engineering drawings</td>
</tr>
<tr>
<td>ENGR 200</td>
<td>Materials of Engineering</td>
<td>Lab reports</td>
</tr>
<tr>
<td>ENGR 235</td>
<td>Surveying</td>
<td>Engineering drawings, logbooks</td>
</tr>
<tr>
<td>ENGR 300</td>
<td>Engineering Experimentation</td>
<td>Oral presentations, lab reports</td>
</tr>
<tr>
<td>ENGR 302</td>
<td>Experimental Analysis</td>
<td>Oral presentations, lab reports</td>
</tr>
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<td>ENGR 430</td>
<td>Soil Mechanics</td>
<td>Project report</td>
</tr>
<tr>
<td>ENGR 696</td>
<td>Engineering Design Project I</td>
<td>Oral presentations, Project report</td>
</tr>
<tr>
<td>ENGR 697</td>
<td>Engineering Design Project II</td>
<td>Oral presentations, Project report</td>
</tr>
</tbody>
</table>

**Teamwork** – Teamwork is taught in many courses through requiring students to produce engineering labs and projects in groups. Engineering classes with labs requiring teamwork are ENGR 100, 200, 235, 300, 302, and 430. Required courses with team design projects are ENGR 430, 696, and 697. We have designed our curriculum to require students to work extensively in teams to prepare them for work in professional practice.

**Economics** – The economics of a project are frequently included in the evaluation of a project’s feasibility. Many students (at least 40%) take ENGR 610 (Cost analysis). This course focuses on the importance of developing the true cost of a project. In ENGR 430 (Soil Mechanics), students must compile a simulated cost of the semester project and submit it to the client. In ENGR 431 (Foundation Engineering), students must choose the most economical foundation type in the semester design project. In ENGR 696 and 697 (Senior Project I and II), students examine a number of constraints on their projects including economic. In ENGR429 (Construction Management), students learn how to determine the costs of the final construction of a project. In summary, economics is covered in multiple courses throughout the civil engineering curriculum.

**Environmental and social** – Students are required to take ENGR 434 (Introduction to Environmental Engineering). In this class, political, social, and environmental factors of society are covered. In ENGR 696 and 697 (Senior Project I and II) students must evaluate 5 project constraints, and most choose to examine the environmental effects of their project.
Ethics – The ASCE code of ethics is covered in ENGR 429 (Construction Management). In ENGR 696 (Senior Project I) students must write a paper on engineering ethics. This usually involves the ethics of environmental pollution.

Lifelong learning – The importance of lifelong learning is addressed first in ENGR 100 (Introduction to Engineering). In ENGR 696 and 697 (Senior Project I and II), students are required to perform lifelong learning exercises. They must attend 3 outside lectures in engineering and 2 society business meetings per semester. In their projects, they must go beyond what is taught in the courses. In addition, the importance of lifelong learning is lectured upon.

Professional certification – The importance of professional certification is first emphasized in ENGR 100 (Introduction to Engineering). In the class the process of obtaining an engineering license is explained. In ENGR 102 (Statics), the Fundamentals of Engineering exam is explained in detail along with explanations of how to prepare for the exam. In ENGR 696 and 697 (Senior Project I and II) the importance of professional certification is again emphasized.

Professional societies – The importance of ASCE in the profession is first explained in ENGR 100 (Introduction to Engineering). In ENGR 696 and 697 (Senior Project I and II), students commonly attend ASCE meetings as part of their lifelong learning exercises. The value of attending ASCE events and being a member of ASCE is lectured upon. Other societies, such as EERI, and their value is also explained (and we have participated in EERI competitions in these courses). The value of other civil engineering societies is also addressed in these courses. Students become very familiar and understand the importance of at least ASCE at the end of their education at SFSU.

In summary, we thoroughly cover all the aspects of our objectives throughout the civil engineering curriculum.

A.3 and A.4 Prerequisite structure and the attainment of student outcomes

The prerequisite structure of the civil engineering program is set up so that student outcomes are achieved in a step by step manner. The central thread is one that takes students from basic math and physics to fundamental structural analysis to complex analysis then design. Along the way, students are taken from basic experimentation to detailed engineering experimentation involving design. A flow chart illustrating the prerequisite structure is presented in the following figure, Figure 5.1.
Civil Engineering Pre-requisite Flowchart (C next to arrow means course must either be completed or taken concurrently)

(Math 226) Calculus I C or better
  └── (Math 227) Calculus II C or better
      └── (Math 228) Calculus III C or better
           └── (Math 245) Differential Equations + Linear Algebra

(Chem 180) Chem I

(ENGR 100) Introduction to Engineering
  └── (ENGR 101) Engineering Graphics
      └── (ENGR 102) Statics
           └── (ENGR 103) Introduction to Computers

(Phys 220/2) Physics I – Mechanics C or better

(ENGR 200) Materials of Engin.

(ENGR 201) Dynamics
  └── (ENGR 205) Electric Circuits

(ENGR 300) Engineering Experimentation

(ENGR 302) Exper. Analysis
  └── (ENGR 304) Mech. Of Fluids
      └── (ENGR 309) Mech. Of Solids
           └── (ENGR 323) Struct. Analysis
                └── (ENGR 425) Concrete Str.

(ENGR 429) Construct. management
  └── (ENGR 430) Soil Mech.
      └── (ENGR 434) Envir. Engineering
           └── (ENGR 436) Transp Engin

21 units of upper division civil engineering

(ENGR 696) Engin. Design Proj. I

(ENGR 697) Engin. Design Proj. II
A.5 How Program meets the Requirements of Math, Science, Engineering and General Education

As shown in Table 5.1, there are 33 units of basic math and science in our curriculum. This includes Calculus 1, 2, 3, linear algebra, and differential equations for math. For science, we have 3 units of Chemistry, 12 units of Physics and 3 units of biology (through general education). We have 61 units of engineering and 33 units (excluding biology) of general education. This meets the ABET requirements.

A.6 Major Design Experience

The major design experience takes place over two consecutive semesters (in most cases, the last two semesters) in ENGR 696 and 697 (Design project I and II). Students are required to have taken approximately 21 units in upper division engineering and be concurrently enrolled in design courses. This assures that they have the background to perform design.

In ENGR 696, students break up into groups and choose a project in coordination with the course instructor. This project is then approved by a faculty advisor (who may not be the course instructor) in the specialty field required by the project. In approving a project, the course instructor and faculty advisor consider the scope and level of design experience. The project must be significant but not so large that it cannot be completed in two semesters. For instance, the following projects were selected and approved in the recent semesters:

- ASCE Steel bridge design competition
- National EERI Seismic design competition
- National Timber bridge design competition
- Geotechnical design project (Foundation design for high rise structure and surrounding residential area)

These projects are typical of what have been approved in the past. We have had projects in environmental engineering and construction management also, but each year is different. Students choose a project of interest. Some years, we have students primarily interested in structural and geotechnical engineering. In other years, construction or environmental projects may be of interest. Structural engineering has always been a favorite among students, though, so the majority of the projects over the years have been in structural engineering.

We encourage student groups to participate in the national design competitions. These competitions have multiple design constraints. We have found the competitions to be excellent design and construction projects. Each year, students start from scratch and are creative in their approaches in their designs.

Our groups have been successful in some of the competitions. In particular, we have done well in the National EERI seismic competition and the National ASCE Timber Bridge Competition. The results are shown in Table 5-4.
<table>
<thead>
<tr>
<th>Competition Name</th>
<th>Year</th>
<th>National Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>EERI</td>
<td>2011</td>
<td>23</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2012</td>
<td>20</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2013</td>
<td>18</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2015</td>
<td>28</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2016</td>
<td>9</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2016</td>
<td>3</td>
<td>Proposal</td>
</tr>
<tr>
<td>EERI</td>
<td>2017</td>
<td>23</td>
<td>Overall</td>
</tr>
<tr>
<td>EERI</td>
<td>2017</td>
<td>1</td>
<td>Seismic Performance</td>
</tr>
<tr>
<td>ASCE Steel Bridge</td>
<td>2007</td>
<td>19</td>
<td>Overall</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2011</td>
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<td>Most Innovative Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2011</td>
<td>1</td>
<td>Most Aesthetic Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2011</td>
<td>2</td>
<td>Most Practical Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2013</td>
<td>1</td>
<td>Most Innovative Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2013</td>
<td>1</td>
<td>Most Aesthetic Design</td>
</tr>
<tr>
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<td>2013</td>
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<td>Most Practical Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2014</td>
<td>1</td>
<td>Most Innovative Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2014</td>
<td>1</td>
<td>Most Aesthetic Design</td>
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<td>4</td>
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</tr>
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</tr>
<tr>
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<td>ASCE Timber Bridge</td>
<td>2017</td>
<td>3</td>
<td>Most Innovative Design</td>
</tr>
<tr>
<td>ASCE Timber Bridge</td>
<td>2017</td>
<td>2</td>
<td>Most Aesthetic Design</td>
</tr>
</tbody>
</table>

We are very proud of our teams and their performance over the years. Our EERI teams routinely beat top engineering schools such as University of Michigan, University of Illinois, Stanford University, University of Texas, and others. In fact, this is really an international competition because teams from Europe and Asia compete. Each team has to qualify to enter the competition by submitting a proposal. Each proposal is ranked without the judges knowing the name of the school submitting the proposal. Approximately, the top 35 proposals are accepted and those teams are allowed to enter a tower. In 2016, our team placed 3rd in the competition for the proposal and 9th place overall. In 2017, our team placed 1st in Seismic Performance and 23rd overall. This is the first time that a SFSU Engineering team has ever scored first place in a highly competitive international competition. This team beat the best from the top engineering schools throughout the world. The students’ hard work over the many years they spent at SFSU paid off handsomely in this event.

Our Timber Bridge teams also beat top engineering schools such as Ohio State University, Oklahoma State University, Oregon State University, University of Missouri, and
others. We are especially happy that they perform so well in the Most Innovative Design category. We encourage them to be creative because the senior project is the time to do something unusual. Our 2013 group built a bridge inspired by a real type of drawbridge in London that rolls up into a spiral. We were skeptical that they could actually do this and build a bridge that could resist the very substantial load. We nearly made them change course in the middle of the project. But they persisted, accomplished their goal, and won most innovative design. Overall, we are very satisfied with our groups’ performance in this competition.

We have been less successful in the ASCE Steel Bridge competition. The last time we made it to the national competition was in 2007 when we placed 19th in the nation. To make it to the national competition, we need to take first or second in our regional. UC Berkeley almost always wins the regional partly because they have a huge budget. That leaves only one space available. Our regional brings in teams from China and Japan. It is very tough to win second place, but we continue to try. Our groups build solid, capable bridges, but they usually are slow in the race to build on competition day and as a result, we have difficulty getting that 2nd place in the regional so that we make it to the national competition.

All projects are required to follow standard design methodology. Groups participating in design competitions follow (approximately, depending on the competition) this methodology:

1. Evaluation phase
   a. Study the competition rules. These rules list multiple design constraints and use appropriate engineering standards.
   b. Summarize the multiple design constraints and develop an understanding of the weighting and importance of each constraint.
   c. Evaluate and study entries from previous years.
   d. Develop approximate time/task schedule.

2. Creative phase
   a. Develop multiple design concepts.
   b. Debate and discuss the merits of each concept with regard to the multiple design constraints.

3. Analysis phase
   a. Perform preliminary analyses of concepts that have the best potential.
   b. Perform independent checks on all preliminary analyses.
   c. Perform basic finite element computer based analyses.
   d. Develop confidence in analytical methods by getting agreement between hand calculations and computer based calculations.

4. Refinement phase
a. Use the analysis results to focus on two or more basic designs.
b. Add complexity and details to the basic designs.
c. Repeat analyses with more detail on basic designs.
d. Complete two tower designs for the seismic competition and three bridge designs for the bridge competitions.
e. Prepare detailed drawings for each design including member types and sizes.
f. Develop approximate costs for each design.
g. Evaluate constructability of each design.
h. Choose the best design based on constraints such as economic, environmental and others.
i. Create time/task schedule.

5. Construction phase

a. Prepare construction plan including construction methodologies, tools, and time schedule.
b. Begin construction.
c. Refine construction methods.
d. Complete construction (modify and analyze design changes as necessary).
e. Test constructed model prior to taking to competition.
f. Modify and analyze design changes as necessary.

Groups not engaged in a competition follow approximately the same methodology but do not have the construction phase. The instructor or advisor supplies the “rules” in a sense that they determine what needs to be designed and the multiple design constraints and the appropriate engineering standards. Competition groups also need to raise capital to fund their projects (usually by soliciting money from local industry).

Each group must act as an efficient team to complete the projects. Each group is required to elect a project manager. All members are expected to participate equally. However, because disagreements occur over design decisions among group members, the project manager is given the authority to have the final say. In addition, the project manager is responsible for making sure the project runs on schedule and that the roles of group members are being performed properly. The project manager is also responsible for making sure that submittals are properly made to the course instructor. All members take roles in the project and are expected to make significant contributions to the project’s success.

All groups are required to address at least five of the following factors and answer the associated questions:
• Economic. What economic factors encourage or discourage undertaking such a project? What might be the limits on available funds? Who would provide the funds?
• Environmental. What are the environmental impacts and benefits of the project?
• Sustainability. Will the project be sustainable in the long run?
• Manufacturability. Can this project be constructed? What aspects or parts of the project might be difficult (or impossible) to construct?
• Ethical. What ethical issues might arise during project development, construction, or use?
• Health and safety issues. What health and safety issues do you see for workers during construction or the general public when project is in use?
• Social. Does the project present social issues?
• Political. Does the project present political issues?

In the first semester students must:
1. Submit an intermediate report representing all the work done that semester.
2. Make an oral presentation reporting all the work done that semester.
3. Perform lifelong learning by attending 3 seminars and 2 business meetings over the course of the semester.
4. Write a paper on ethics

In the second semester, students must:
1. Finish the project (analysis, design, and construction).
2. Submit a final report.
3. Make a final oral presentation
4. Perform lifelong learning by attending 3 seminars and 2 business meetings over the course of the semester.
5. Make a poster and present it at the College of Science and Engineering competition.

A.7 Cooperative education
The civil engineering program does not give any course credit for cooperative education.

A.8 Materials available for review
Course portfolios consisting of syllabi, textbooks, student homework, projects, lab reports, quizzes and exams will be available for review.

B. Course Syllabi

Civil engineering course syllabi are included in Appendix A.
CRITERION 6. FACULTY

A. Faculty Qualifications

The faculty in the Civil Engineering Program (and in the School of Engineering) is characterized by its excellent academic qualifications and practical engineering experience. All faculty have a demonstrated commitment to excellence in teaching. The ethnic diversity of the engineering faculty enhances rapport with our students, who come from the rich mixture of racial and cultural diversity in the San Francisco Bay area. We believe that faculty, students, and staff all benefit from working within a culturally diverse group.

There are seven full-time faculty members, seven part-time instructors in the civil engineering program. Table 6-1 lists faculty qualifications, degree, rank, professional registration, and activity levels in research, consulting, and professional societies. Faculty Vitae (Appendix B) provide more detailed information about faculty professional activities. This group has an excellent spread of long-time teachers and recent PhDs. The average teaching experience for the full-time faculty exceeds sixteen years, with two faculty senior members averaging more than 30 years. Six full-time civil engineering faculty are registered Professional Engineers and have consulting and/or industrial experience, and have earned doctoral degrees. Newly tenured faculty are expected to obtain a PE license before seeking a promotion. By all measures, all TT/T faculty are competent to direct the civil engineering curriculum and to teach the civil engineering design courses effectively. Details on individual faculty are provided in the resumes in Appendix B.
<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>Highest Degree Earned- Field and Year</th>
<th>Rank</th>
<th>Type of Academic Appointment</th>
<th>FT or PT</th>
<th>Years of Experience</th>
<th>Professional Registration/ Certification</th>
<th>Level of Activity⁴</th>
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<tbody>
<tr>
<td>Cheng Chen</td>
<td>Ph.D., Civil Engineering (Structural), 2007</td>
<td>AS</td>
<td>C T</td>
<td>FT</td>
<td>8</td>
<td>M</td>
<td>H, M, or L</td>
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<tr>
<td>Timothy D'Orazio</td>
<td>Ph.D., Civil Engineering (Geotechnical), 1982</td>
<td>P</td>
<td>T FT</td>
<td>4</td>
<td>32</td>
<td>PE-CA</td>
<td>M, M, L</td>
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<tr>
<td>Elahe Enssani</td>
<td>PhD., Civil Engineering, 1987</td>
<td>AS</td>
<td>C T</td>
<td>FT</td>
<td>7</td>
<td>PE in sanitary Engineering-AZ</td>
<td>M, H, L</td>
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<tr>
<td>Zhaoshuo Jiang</td>
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<td>AS</td>
<td>TT FT</td>
<td>6</td>
<td>5</td>
<td>PE-CA,</td>
<td>H, H, H</td>
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</table>

³ FT or PT indicates Full Time or Part Time.
⁴ Level of Activity: H (High), M (Medium), L (Low)
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<thead>
<tr>
<th>Name</th>
<th>Degree and Field</th>
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<th>LEED</th>
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<td>Wenshen Pong</td>
<td>Ph.D. Structural Engineering, 1994</td>
<td>P</td>
<td>T</td>
<td>FT</td>
<td>6</td>
<td>18</td>
<td>18</td>
<td>PE-CA</td>
<td>M</td>
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</tr>
<tr>
<td>Ghassan Tarakji</td>
<td>Ph.D., Civil Engineering, 1983</td>
<td>P</td>
<td>T</td>
<td>F</td>
<td>2</td>
<td>33</td>
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<tr>
<td>Jenna Wong</td>
<td>Ph.D., Structural Engineering, 2014</td>
<td>AS T</td>
<td>TT</td>
<td>FT</td>
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<td>2</td>
<td>2</td>
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<td>M</td>
</tr>
<tr>
<td>Dragomir Bogdanic</td>
<td>M.S. Civil/Environmental Engineering</td>
<td>I</td>
<td>NTT</td>
<td>PT</td>
<td>25</td>
<td>15</td>
<td>13</td>
<td>PE-CA</td>
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<tr>
<td>Justin Brodowski</td>
<td>M.S. Structural Engineering, 2009</td>
<td>A</td>
<td>NTT</td>
<td>PT</td>
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<td>H</td>
</tr>
<tr>
<td>Natalia Igu</td>
<td>Ph.D., Mechanical Engineering, 2008</td>
<td>A</td>
<td>NTT</td>
<td>PT</td>
<td>4</td>
<td>29</td>
<td>3</td>
<td>COREN</td>
<td>M</td>
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<tr>
<td>Robert Paul Levenson</td>
<td>M.S. Civil Engineering, 2006</td>
<td>I</td>
<td>NTT</td>
<td>PT</td>
<td>40</td>
<td>6</td>
<td>6</td>
<td>PE-CA</td>
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<td>L</td>
</tr>
<tr>
<td>Mutlu Ozer</td>
<td>M.S. Engineering 2003</td>
<td>I</td>
<td>NTT</td>
<td>PT</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>FE</td>
<td>ASH</td>
<td>RAE</td>
</tr>
<tr>
<td>Jonathon Tai</td>
<td>M.S. Structural Engineering 2011</td>
<td>I</td>
<td>NNT</td>
<td>PT</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>PE-CA</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Yuan-Hunh Paul Tan</td>
<td>Ph.D. Civil Engineering, 2010</td>
<td>I</td>
<td>NTT</td>
<td>PT</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>PE-CA</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>
Instructions: Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor   ASC = Associate Professor   AST = Assistant Professor   I = Instructor   A = Adjunct   O = Other
2. Code: TT = Tenure Track   T = Tenured   NTT = Non Tenure Track
3. At the institution
4. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.
<table>
<thead>
<tr>
<th>Faculty Member (name)</th>
<th>PT or FT</th>
<th>Classes Taught (Course No./Credit Hrs.) Term and Year</th>
<th>Program Activity Distribution</th>
<th>% of Time Devoted to the Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Term and Year</td>
<td>Teaching</td>
<td>Research or Scholarship</td>
</tr>
<tr>
<td>Cheng Chen</td>
<td>FT</td>
<td>ENGR 323 (3) S16; ENGR 461 (3) F16; ENGR 696 (1) S16; ENGR 697(2) F16</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>Timothy D'Orazio</td>
<td>FT</td>
<td>ENGR 102 (3) F16, ENGR 309(3) SP 16, F16, ENGR 430(3), S16, ENGR 431(3) F16, ENGR 696 (1) F16, ENGR 697 (2) S16</td>
<td>75%</td>
<td>10%</td>
</tr>
<tr>
<td>Elahe Enssani</td>
<td>FT</td>
<td>ENGR 304 (3) S16, F16, ENGR 434 (3) S16, F16, ENGR 435 (3) S16, ENGR 697 (3) F16</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Zhaoshuo Jiang</td>
<td>FT</td>
<td>ENGR 425 (3) S16, F16, ENGR 831 (3) F16</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Wenshen Pong</td>
<td>FT</td>
<td>ENGR 425 (3) S17</td>
<td>0%</td>
<td>10%</td>
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</table>

Table 6-2. Faculty Workload Summary

Civil Engineering
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Courses</th>
<th>FT</th>
<th>PT</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghassan Tarakji</td>
<td>FT</td>
<td>ENGR 235 (3) S16, F16, ENGR 429(3) S16, F16, ENGR 436 (3) S16, F16, ENGR 439 (3) F16</td>
<td>90%</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Jenna Wong</td>
<td>FT</td>
<td>ENGR 102 (3) S16, F16, ENGR 426 (3) S16, ENGR 800 (3) F16</td>
<td>50%</td>
<td>50</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Dragomir Bogdanic</td>
<td>PT</td>
<td>ENGR 436 (3) S16, F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Justin Brodowski</td>
<td>PT</td>
<td>ENGR 427 (3) F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Natalia Igu</td>
<td>PT</td>
<td>ENGR 200 (3) S16, F16, ENGR 204 (3) S16</td>
<td>100%</td>
<td></td>
<td></td>
<td>75%</td>
</tr>
<tr>
<td>Robert Paul Levenson</td>
<td>PT</td>
<td>ENGR 100 (1) S16, F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Mutlu Ozer</td>
<td>PT</td>
<td>ENGR 300 (3) S16, F16, ENGR 302 (1) S16, F16, ENGR 610 (3), S16, F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Jonathon Tai</td>
<td>PT</td>
<td>ENGR 302 (1) S16, F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Yuan-Hung Paul Tan</td>
<td>PT</td>
<td>ENGR 201 (3) S16, F16, ENGR 304(3) S16, F16, ENGR 309(3) S16, F16</td>
<td>100%</td>
<td></td>
<td></td>
<td>60%</td>
</tr>
</tbody>
</table>

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the Self-Study Report is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.
B. Faculty Workload

Full-time faculty have 9-month appointments, with a standard full-time teaching load of 12 units per semester. (One teaching unit is either one lecture-hour or 1.5 laboratory-hours) Faculty often have “release time” from teaching for research projects and, in the case of the Program Head, for administrative duties. Table 6-2 shows faculty workload summary for 2016/2017 academic year. Junior probationary faculty usually teach two courses per semester with the release time for research supported by the College and the School.

C. Faculty Size

Both the competency and size of our faculty is sufficient to cover the curricular areas of the civil engineering program. It is also sufficient for beneficial interactions with the students. In addition to the seven TT/T faculty, seven lecturers are also part of civil engineering: Dr. Natali Igu, who teaches engr 200: Materials of Engineering; Dr. Paul Tan, who teaches engr 304: Mechanics of Fluids and engr 309: Mechanics of Solids; Mr. Mutlu Ozer, who teaches courses in engineering experimentation; Mr. Justin Brodowski, who teaches engr 427: Timber Structures; Mr. Dragomir Bogdanic, who teaches engr 436: Transportation Engineering and engr 468: Applied Fluid Mechanics and Hydraulic; Mr. Jonathon Tai, who teaches engr 302: Experimental Analysis and Mr. Robert Levenson, who teaches engr 100: Introduction to Engineering.

Each faculty is required to host 3-hours of office hours per week during the academic semester. Students are encouraged to meet with faculty advisors to discuss their academic and career issues during faculty office hours. Students are required to bring their planning worksheet to meet with their advisor during the mandatory advising weeks, usually from the 10th week to 12th week of the semester, so they are advised what courses to take for the following semester to meet their academic plan. Students and faculty become well acquainted with each other throughout their academic years at SFSU. There is a high level of interaction between students and faculty in the classrooms, laboratories and during office hours. The faculty generally know the students by name.

All civil engineering faculty teach laboratories which facilitate the development of close and more personal relationships with students. Many junior-level classes have less than 40 students, which also fosters greater student-professor contacts. All faculty members actively
advise students on class projects. All faculty members are expected to engage in university and professional community service, professional development, and have interaction with employers.

**D. Professional Development**

Our faculty is active in professional development through funded and non-funded research, consulting, publishing, workshops, short courses, and attendance at professional conferences. They use this experience to enhance their course presentations and the curriculum in general. All civil engineering faculty are members of ASCE and other professional societies. The School of Engineering sponsors their membership dues. These professional activities also provide enriching interactions with professionals and employers. Most of our faculty have served at one time or another on committees in professional societies. These activities are listed in detail in the faculty CVs (Appendix B) and will not be repeated here.

Our faculty are active in the university community. All of the civil engineering faculty serve on School committees and most serve (or have served) on University and College committees. Faculty serves as faculty judges for the annual college showcase event, graduation marshals, faculty advisors for the student professional organizations, and many other campus-wide service activities. Recent faculty activities are detailed in their resumes. The Center for Teaching and Faculty Development hosts many workshops in teaching, curriculum development, use of technology in classrooms, student learning assessment, and others in professional development every semester.

The Faculty Affairs and Professional Development office administers many internal grants and travel grants to support faculty professional development. All junior faculty are given a generous start-up fund to establish their research activities which are a very important part of the retention, tenure and promotion criteria. In addition, all junior faculty are given assigned time every semester so they can focus on their teaching and research related scholarly activities.

**E. Authority and Responsibility of Faculty**

The following sections detail the ways in which faculty are involved in the decision-making process of the School of Engineering and, in particular, in two important areas: curriculum development and revision

**E.1 Faculty involvement in decision making**
The School of Engineering is a relatively small and highly collegial program. All major decisions of the School, except budget, involve faculty input in some form. Input comes from program meetings, program heads’ meetings, school meetings, and from committees that the faculty constitutes to manage its affairs.

- Program meetings: The civil engineering program has program meetings on Wednesdays from 1:10-2:00 no less frequently than every month during the semester to go over program development, curriculum, advising and other issues related to the program.

- Program heads meeting: Program heads meet with the director on a regular schedule to consult about issues relating to the programs. Issues include curriculum development, assessment, course offering and schedule, continuing improvement and budget issues.

- School meetings: School meetings of faculty and staff from all programs in the School of Engineering occur at least monthly during the semester, generally on Wednesdays from 12:45-2:00. Issues discussed at these meetings include prerequisite requirements, grading policies, withdrawal policies, evaluation, student concerns, professional development opportunities, scholarships, internships, student professional organization activities, class schedule, budget distribution, funding priorities, funding for equipment, and advising procedure are fully discussed in the school meeting. Accreditation-related matters are on the meeting agenda routinely. The Outcome Assessment Committee (OAC) chair is charged to inform and educate the faculty about new developments in ABET requirements and procedures, and makes regular presentations at these meetings. Before each semester begins, there is also a special 4-hour school meeting relating to major issues such as accreditation. All faculty and staff are expected to attend these school meetings. In addition to the formal faculty meetings, the School’s director hosts an informal meeting on Fridays once a month for faculty and staff to come and discuss issues of concern to them.

- Committees: The faculty constitutes a number of committees – both standing and ad hoc – to manage its affairs. The two most important standing committees are the Retention, Tenure and Promotion (RTP) committee, which is described in detail Criterion 8, and the
Outcomes Assessment Committee (OAC), which is responsible for all issues having to do with accreditation and which is discussed below.

**E.2 Curriculum development and revision**

The faculty are directly responsible for choosing the general areas for curriculum development, as well as for developing proposals for specific new courses and laboratory or modifying existing ones. The faculty of the civil engineering program, acting together as a program, decide upon areas of interest to the program, and are responsible for writing the position descriptions that eventually result in the hiring of new faculty in this area. Each faculty member of our program has been hired with expertise in one of the core areas of civil engineering, as shown in Appendix B. The faculty member has primary responsibility to develop and maintain courses and laboratories in his/her areas. New courses and revisions to existing courses are most often proposed by the individual faculty members, or by the program as a whole.

When new courses are proposed, or existing courses are revised, a formal ABET-compliant course syllabus must be prepared, which includes a statement of the appropriate ABET learning outcomes. After the proposal is discussed and approved by the program, it is brought by the program head to the program head’s meeting, where it is discussed with reference to its relevance, effects on other programs and overall fit with the School’s mission and objectives. The director of the School makes the final decision with respect to offering a course, based on the proposal’s merits as well as a consideration of the course’s scheduling and staffing needs and the School’s resources.

**E.3 Accreditation**

The main faculty entity responsible for all accreditation matters in the School of Engineering is the Outcomes Assessment Committee (OAC). This committee comprises the director of the School, the program heads and one members-at-large, appointed by the director. The OAC is responsible for developing and reviewing the School’s assessment policies and procedures. It works with the programs to develop instruments to survey the School’s significant
constituencies, evaluate their inputs and propose such modifications as are deemed necessary to make the mission and objectives easily assessable, more compatible with current thinking regarding engineering education, and more reflective of the needs and requirements of the constituencies, the School of Engineering and ABET.

Surveys developed by the OAC include the alumni and student surveys of the appropriateness of mission and objectives and the employer and alumni surveys of the achievement of the program educational objectives. The committee determines those courses that are most appropriate to be assessed for the achievement of particular student outcomes and members of the committee work then with individual faculty members in charge of the designated course to develop the course-based assessment reports (CBARs). The committee analyzes the assessment data, processes the data and proposes changes, where appropriate, in policies, procedure and curriculum necessary to meet program objectives and student outcomes. Recommendations are brought to the program and the faculty for consideration and action.
CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

Offices

Full-time engineering faculty members are assigned individual offices, which are located in the Science Building. Part-time faculty members generally share an office with another part-time faculty member. Offices are of sufficient size to accommodate desks, chairs, bookshelves, computers, printers and other standard equipment. All faculty offices are equipped with the telephones, high-speed internet connections and wireless networking, which are installed and maintained by the University’s Division of Information Technology. The University has in place a program to periodically replace the desktop or laptop computers with current models in the faculty offices in order to meet their teaching and research needs.

Classes

Classrooms at San Francisco State University are classified as interdisciplinary. The School of Engineering uses classrooms in its own building (the Science Building) and also rooms in other buildings throughout the campus. These rooms vary in size from small (20 seats) to large (150 seats). All classrooms have some type of writing board, either a traditional chalkboard or a whiteboard, and most have audio visual facilities for instructors to use computers as part of their lectures and demonstrations, including screens and projectors. Many rooms are designated as electronically enhanced classrooms, which means that in addition to the video/data projector, they have a VCR/DVD player, cablecast reception and a sound system (some have microphones). Some consoles also have a video overhead (for opaque materials as well as transparencies). All rooms have internet access, either through hardwired internet connection or through the campus wireless system.

Scheduling of classrooms is done by a central University office and is based on class size, priority level and equipment needed. The School of Engineering enjoys priority in using classrooms in the Science Building. The classrooms and the scheduling process are adequate.
Laboratories

The laboratory facilities that support the teaching and research functions of the School of Engineering are all located in the Science Building on campus. The laboratory facilities and the courses they support are summarized in the lab descriptions that follow. Only laboratories that are used by students in civil engineering are described in this section. These lab facilities are identified and briefly summarized in the lab descriptions below.

Engineering Experimentation Laboratory (Science 111)

The available equipment includes seven PC stations equipped with 8 true differential channel automated data acquisition boards. Assorted instrumentation is also available for use with these systems, including load cells, LVDTs, thermocouples, and pressure transducers. Also available are oscilloscopes, multimeters, and other common measuring devices. Eight bench-top fuel cell laboratory kits were purchased recently to enhance the lab experiment for ENGR 300. The equipment for this laboratory is well suited to the purpose of ENGR 300 (Engineering Experimentation).

Concrete Testing Laboratory (SCI 164)

This laboratory contains the following equipment:
- Concrete mixing equipment (pans, shovels)
- Equipment for various tests of fresh concrete (slump cone, Kelly ball)
- Plastic curing cylinders
- Capping apparatus
- Concrete cylinder compression tester

This equipment is satisfactory for the instructional component on concrete properties in ENGR 200. This lab utilizes a portion of the basement of the Science Building for students to mix, cure, and test concrete.

Fluids/Thermodynamics/Solids Laboratory (Science 169)

The following equipment is housed in this lab for use in Experimental Analysis (ENGR 302) and Thermal Power Systems (ENGR 463):
- Pipe-flow friction rig
- Pelton wheel water turbine
- Orifice/venturi flow measuring equipment
- Diesel engine with dynamometer and fuel flow instrumentation
- Two speed centrifugal pump with data acquisition
- Water channel
- Pin fin heat transfer setup with data acquisition
- Vibration experiment
- Beam bending with data acquisition (located in Science 164)
- Significant upgrades have brought this lab up-to-date. The equipment for ENGR 302 is considered to be adequate.

**Geotechnical Laboratory (Science 114)**

The following equipment/instruments are available in this lab, with the capability of each equipment/instruments outlined next to it:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave oven</td>
<td>Quick water content determination</td>
</tr>
<tr>
<td>Conventional oven</td>
<td>Water content determination</td>
</tr>
<tr>
<td>Electronic scales</td>
<td>Soil weight</td>
</tr>
<tr>
<td>Compaction molds and hammers</td>
<td>Soil compaction characteristics</td>
</tr>
<tr>
<td>Sand cone density equipment</td>
<td>In situ density</td>
</tr>
<tr>
<td>Liquid limit device</td>
<td>Soil liquid limit</td>
</tr>
<tr>
<td>Plastic limit plates</td>
<td>Soil plastic limit</td>
</tr>
<tr>
<td>Sieves</td>
<td>Grain size determination, soil preparation</td>
</tr>
<tr>
<td>Sieve shaker</td>
<td>Grain size determination</td>
</tr>
<tr>
<td>Hydrometer</td>
<td>Grain size determination</td>
</tr>
<tr>
<td>Mortar and pestel</td>
<td>Soil preparation</td>
</tr>
<tr>
<td>Hydraulic jack and extruder</td>
<td>Soil extrusion</td>
</tr>
<tr>
<td>Consolidation equipment</td>
<td>Consolidation</td>
</tr>
<tr>
<td>Triaxial cell</td>
<td>Triaxial testing</td>
</tr>
<tr>
<td>Load frame</td>
<td>Loading</td>
</tr>
<tr>
<td>Pore pressure panel board</td>
<td>Pore pressure control and measurement</td>
</tr>
<tr>
<td>Fixed wall permeameter</td>
<td>Lab permeability</td>
</tr>
<tr>
<td>Miniature sealed double ring infiltrometer</td>
<td>Field permeability</td>
</tr>
<tr>
<td>Borehole permeameter</td>
<td>Field permeability</td>
</tr>
<tr>
<td>Guelph permeameter</td>
<td>Field permeability</td>
</tr>
<tr>
<td>Dam flow model</td>
<td>Flow net, pore pressure, and permeability demo</td>
</tr>
<tr>
<td>Quicksand chamber</td>
<td>Quicksand demonstration</td>
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<tr>
<td>Retaining wall force model</td>
<td>Retaining wall rotation demonstration</td>
</tr>
<tr>
<td>Fault slippage model</td>
<td>Fault slippage demonstration</td>
</tr>
<tr>
<td>Landslide model</td>
<td>Landslide demonstration</td>
</tr>
</tbody>
</table>
Falling head permeameter Permeability of coarse grained soils
Soils magic demonstration equipment Illustrate soil concepts
Electronic scale Weight of small samples
Direct shear device Soil strength

This equipment, along with miscellaneous support equipment, is sufficient for a first-course on soil mechanics lab. The Direct Shear Testing Device is the most recent significant piece of equipment. Much of the equipment is modern.

Materials Testing and Metallurgy Laboratories (Science 164)
This lab is used for the required sophomore course, ENGR 200 (Engineering Materials), and for supporting student projects in the areas of mechanical behavior of materials and metallurgy. The lab contains two universal testing machines (Tinius Olsen and Instron 3369 Tensile Test Machine), four hardness testers (3x Rockwell Hardness Tester and 1x Brinell Harness Tester), an impact testing machine, a concrete compression machine, box furnaces for heat treatment, stereomicroscope, and equipment for metallographic preparation of specimens. In particular, the software and controller of the Instron 3369 have been upgrade in March 2017. A new computer terminal was purchased and it currently runs the latest version of Bluehill, the new Instron software.

Structural Mechanics Laboratory (Science 113)
The School has established a state-of-the-art structural laboratory, funded by two NSF grants: (i) NSF CCLI, and (ii) NSF MRI grants, to enhance our civil engineering student’s experimental abilities in structural engineering. The lab is mainly used for structural response experiments in support of various structural engineering courses (including Engr 323: Structural Analysis) and also for undergraduate research. The equipment available in this lab includes:
- Two 50 kN dynamic actuators
- One 50 gpm servo hydraulic power unit
- MTS servo-hydraulic controller with hybrid simulation capability
- One graphics plotter
- Two accelerometer power supply/gain units
- Several accelerometers
- One linear variable differential transformer
- One HI-TECH MAGNUS steel testing frame with 1000 kN axial load capacity
- One static load equipment
- Hilton engineering teaching equipment including a universal frame and stand, beam for deflections and digital display interface
- Two Quanser shaker tables (one with 3-story model structure and one with AMD system)

The shaker table has been upgraded in the last two years. The undergraduate Timber Bridge and Steel Bridge competition teams have used this lab extensively to build their bridges.

Surveying Laboratory (Science 114)

The following equipment is available in this lab:

- 5 Leitz Automatic Levels
- 3 Leitz optical theodolites with 10" accuracy (one is in repair)
- 3 Qualtest QTS-Series Total Stations
- 7 4-segment fiberglass telescopic rods
- 1 Total Station with Optical Angle reading (Leitz SDM3F)
- 2 Total Station with Electronic Angle Reading (SOKKIA Set 5 and Set 5A)
- 3 single lens prisms
- 7 Tripods
- 6 Direct Elevation roads
- 1 tension balance scale
- 7 16 Oz. Plumb Bobs with Gammon Reel
- 5 Hand Levels
- 6 Rod Levels
- 4 3’ Measuring Wheels
- 8 100’ Steel Tapes
- 2 100’ Woven Tapes
- 3 Sets Staking Pins
- 3 Sets Range Poles
- 1 set Rhino Hand-held GPS receiver with 2-way communication
- 3 sets Sokkia GPS sets

The equipment is quantitatively and qualitatively adequate for a basic surveying laboratory. The total stations have electronic data collection capabilities, and the data can be downloaded into personal computers for processing. With this equipment, all surveying experiments required for a first surveying course (ENGR 235) in Civil Engineering can be performed. This equipment provides adequate instrumentation for our class sizes, with an
additional set of instruments available for replacing equipment needing maintenance and/or repair.

**B. Computing Resources**

There are a variety of computing resources available to faculty and students in the School of Engineering and also in the University. The quality and quantity of those resources is adequate to support the program objectives.

The School supports both course-specific computing resources and general-purpose computing resources. The course-specific resources, which have been described in Section A.3, are geared to specific instructional laboratories, and are available to students enrolled in the appropriate courses. The general-purpose computing resources of the School of Engineering include two computer labs: the timeshare lab and the multimedia computer (CAD) lab. Over the past few years, the School has upgraded these two labs several times. In most of the computers in the School of Engineering, general-purpose and course-specific application software such as Matlab, LabView, various programming languages and database software is available to students for the completion of their homework and project assignments. Moreover all the computers have SSH and Xming tools used for establishing remote connection to the servers hosting various EDA tools. Students also have unrestricted access to the Internet. All School of Engineering computing resources are overseen by a computer manager who facilitates and supervises the work of the laboratories.

**Timeshare Laboratory (SCI-143)**

This laboratory is designed to facilitate computer usage for all students on campus, but is mainly used by engineering students. Currently, this laboratory has 19 2.0Ghz dual core Dell PC workstations, each with 8GB of RAM, a 150 GB hard disk and 19” flat-screen monitors, and one 3.5Ghz Lenovo PC workstation with 10GB of RAM, a 450GB hard disk and 19” flat-screen monitor, which were last upgraded on October the 22nd of 2008. The lab’s computers are connected to the University network via high-speed wiring and switches. All the computers in
this lab are also connected to the engineering LAN, with servers running the Windows operating systems. There is one HP laser printer for student use.

**Multimedia Computer (CAD) Laboratory (SCI-146)**

This laboratory is designed to facilitate the teaching of various engineering courses that require extensive use of computer software, such as ENGR 106 (Introduction of Engineering Laboratory), the laboratory that accompanies ENGR 100 (Introduction to Engineering). In this laboratory, students learn how to use Matlab, Excel, and other software. When the laboratory is not scheduled for class, it is open to all engineering students. The laboratory comprises 31 3.1 GHz dual core Dell PCs, each with 16GB of RAM, a 927 GB hard disk and a 24” monitor. All computers are connected to the University network via high-speed wiring and switches.

**General Software**

The following general software is available to our students on computers maintained by the School of Engineering for use with homework, laboratory projects, and design projects.

- Various compilers (Fortran, C++, Basic, etc.)
- Microsoft Office (Word, Excel, PowerPoint, etc.)
- AutoCAD 2000, a general drafting and design software
- Matlab and Simulink
- SAP 2000, a finite element analysis software for solids and structures
- Pro-Engineer and Pro-Mechanica, a general mechanical engineering drafting, design and computational tool.
- PSpice, a circuit simulation tool
- ETABS, a structural analysis software
- RISA, a structural analysis/design software
- Micro Soft Project, a project scheduling software
- SSH and Xming (for establishing remote terminal and graphic connection to various servers)
- Solidworks
- Trace 700
In addition, the school has several servers located in various labs that host Unix/Linux-based applications that can be run remotely on the server. These servers host engineering design and simulation software. The entire Synopsys Design Suite is maintained on servers in the Nano-Electronics and Computing Lab. The Cadence Design Suite is maintained on servers in the Analog Electronics Lab. These servers are accessible from all the computers in the Timeshare Lab and the Multimedia Computer Lab via “Xming” (a PC based X window server). Some of the servers are also accessible from off-campus, which allows students to run application from their personal computers from anywhere.

**University computer resources**

In addition to the computing resources provided in the School of Engineering, the University maintains computing laboratories around campus, including dormitories, which are open to all students, some 24 hours a day. The following six campus-wide computer laboratories, which are accessible by all SF students:

- Library. Open 24 hours
- Cesar Chavez Student Center (T-143). Open from 7:30am to 9:00pm from Monday to Thursday and 7:30am to 7:00pm on Friday
- Behavioral & Social Sciences (HSS 383). Open from 9:30am to 9:00pm from Monday to Thursday and 9:30am to 7:00pm on Friday
- College of Business (BUS 209). Open from 9:00am to 7:00pm from Monday to Thursday and 12:30pm to 5:00pm on Friday
- College of Health & Human Services (HSS 219 and BH 217). The open hours varies to accommodate class visits.

For students and faculty who are interested in computation intensive research, the College of Sciences and Engineering has a Center for Computing for Life Sciences (CCLS). Although it was primarily designed for computational biology, it is open to all faculty at SFSU with the approval from the CCLS committee. The Center has two clusters: the Dell HPC Cluster with 10 nodes with 4 processors each and the Instructional Cluster with 6 nodes and 2 processors each. The Center is managed by a dedicated system administrator.

**C. Guidance**
Students are required to use all equipment and laboratories properly and safely. Most of the equipment used by our engineering students falls into two categories: items loaned to students through the stockroom (tracked with a computer cataloging system), and equipment that is permanently installed inside our laboratory and research rooms.

For borrowed equipment, students are presented with usage and safety guidelines during check-out, and the stockroom staff make instructional paperwork available from a maintained catalogue. Further, the full-time stockroom technicians provide appropriate usage and safety advising as necessary for all student project equipment needs.

For equipment installed inside laboratories, School of Engineering instructors teach proper and safe equipment operation, and monitor users throughout experimentation. Most of the laboratory equipment stations have posted specific instructions for the use and safety of our tools and equipment. Students will also receive some general equipment/tool instruction as part of their coursework, such as during ENGR 200 and ENGR 364 experiments.

When it is too time-consuming or dangerous to permit our students to use School of Engineering equipment, such as machining custom parts for projects, the stockroom technicians may allow students to observe as the task is completed by our full-time staff. For example, small-scale project parts, such as ENGR 300 lab design prototypes, are often produced by stockroom technicians in the machine shop. Alternately, our COSE Science Service Center’s technicians and machinists can produce custom-made machine parts for our students to try out their ideas in their capstone design course ENGR 696/697 (Engineering Design Project I and II). Note also that, the School of Engineering sponsor a TechShop membership to all students participating in senior design projects who need to custom fabricate parts.

All School of Engineering computing resources are overseen by a Computer Manager who facilitates and supervises the work of the Time-share and CAD laboratories. Computer guidance is provided by instructors during class sections. The Network Analyst of the College of Science and Engineering provides administrative help with the Unix-based server that run
Cadence software. All other computer laboratories within the university are operated by the Academic Computing Center.

D. Maintenance and Upgrading of Facilities

The School of Engineering has adequate support personnel and the institutional services that are necessary to achieve its educational objectives. Routine maintenance and servicing of laboratory equipment are performed by our two staff technicians of the School of Engineering. One technician services the electronic equipment, computers, printers, and other electronics products, plus general maintenance in all fields. The second technician services mechanical equipment such as universal testing machines, pumps, and motors, and also maintains and operates the machine shop. The second technician also acts as stockroom manager, managing assistants, overseeing laboratories, and maintaining general equipment in the engineering stockroom.

Disposable items, such as cutting implements and tape, are replaced when necessary, using School of Engineering general funds. Large-scale upgrades for laboratory and research equipment are spearheaded by faculty, with technical assistance from stockroom staff. Faculty and lecturers create lab plans, but also give input into needed replacement parts for student-borrowing purposes.

The Science Service Center, located within the College of Science and Engineering, also provides help in maintenance of equipment and instrumentation of our School. We will rely upon our own technicians to make custom repair parts first, but if we do not have the right machines, then our technicians can request part production from the SSC. If outside service or maintenance is needed, the stockroom technicians will contact an appropriate vendor, with expenses drawn from the School of Engineering’s general funds. This is sometimes necessary for major repairs or specialist jobs.

All School of Engineering computing resource maintenance and upgrades are handled by a Computer Manager who facilitates and supervises the work of the Time-share and CAD laboratories, and most computers in the engineering labs. All other computer laboratories within the university are maintained and operated by the Academic Computing Center.
E. Library Services

The J. Paul Leonard Library building has completed its renovation, upgrade and seismic retrofit and has been open to SFSU students and the public since January 2012. The library's main web page is http://www.library.sfsu.edu.

The research commons and café areas within the library are open 24/7 during the fall and spring semesters (except for holidays). The Annex has 400 study spaces and 170 computers (both PCs and Macs). Housed within the library are the current periodicals in print format and a small Reference and Government Documents collection. The library’s reference staff provides in-person reference advice and are available approximately 70 hours a week. An instant message reference service is also offered.

Books within the library are housed in a three-story computerized library retrieval system. The library feature two floors of open book shelves. At the end of the 2016/17 academic year, the library's book and electronic book holdings were 1,107,880 and 168,880 volumes, respectively. The library presently subscribes to approximately 460 periodicals in printed format and 54,697 journals in electronic format, including many items (e.g. IEEE journals and proceedings) of importance to faculty and students in electrical engineering. The library has purchased a subscription to the IEEE database (IEEExplore), which allows faculty and students access to all IEEE publication online from any computer on campus as well as from off campus via the library website. The 2015/16 collections budget is approximately $2,829,599. The library's budget for engineering books and periodicals for 2016/17 is over $56000. This is augmented by other funds that pay for bundled electronic journal and database subscriptions.

There are presently 99 reference librarians and other senior staff available to assist students and faculty, in addition to around 100 student staff. The librarian who serves as the subject specialist for the School of Engineering is Pamela Howard. She is responsible for ordering engineering books for the library, overseeing the engineering periodical collection, providing in-class library instruction sessions, and in-depth reference assistance to engineering
faculty and students upon request. The School of Engineering faculty may submit suggestions for books they would like to have ordered. They are also consulted regarding the engineering periodical holdings (particularly when periodical cancellation projects are undertaken).

The Library subscribes to over 190 databases in electronic format. Access to these databases is available to SFSU faculty, staff, and students through the library's web site from on campus and remotely at home or at work. Subscriptions to these databases is only possible as CSU consortia rates have been negotiated by the CSU's Chancellor's Office in Long Beach. The databases to which the library subscribes that are most appropriate for use by engineering students are:

- *Applied Science and Technology Abstracts* (indexes the core engineering, computer science, physics, geology, and mathematics journals)
- *Engineering Village* (the comprehensive index to the world’s engineering literature)
- *IEEE/IET Electronic Library* (provides full-text access to IEEE and IET journals, magazines, conference proceedings, and standards)
- *MathSciNet* (the comprehensive index to the world’s mathematical literature. Also includes some indexing to the computer science and electrical engineering literature)
- *Web of Science* (a database of scholarly journal articles in all disciplines. Cited reference searching may be done in this database as well)
- *Academic Search Premiere, ABI/Inform Global, and Business Source Premier* provide full-text access to many trade magazines including those for the electronics, computer science, and energy industries.

The *Link+* service provides a way for SFSU students, faculty, and staff to obtain books not available through the J. Paul Leonard Library. Users may order books directly from other libraries through the *Link+* consortia catalog, which includes the holdings of nine CSU libraries and more than 35 other academic and public libraries in California and Nevada. *Link+* books are generally available for pick-up within two to three business days. Journal articles and books not available through the SFSU Library service or the *Link+* service may be requested through the *Illiad* document delivery system and are usually available within two to seven business days.

**F. Overall Comments on Facilities**

All laboratory safety areas are clearly indicated with signage and marked on the floor with high visibility markings, as necessary. Warnings are posted at the entrance of laboratories.
indicating the dangers that are inherent in each room. Safety directions are permanently placed near potentially dangerous equipment inside School of Engineering facilities. Stockroom technical staff is responsible for reporting broken or damaged equipment and acting quickly to repair, replace, or remove it.

All users receive training on proper use of equipment prior to being allowed access, with specific emphasis on associated safety issues. Any tools or equipment that are loaned to students must be inspected for safety, and students are instructed on safe usage. Safety supplies are also loaned to students as necessary, such as impact goggles, ear plugs, or gloves. Upon return from students or instructors, equipment is inspected for operability and safety issue. In laboratories, faculty or staff monitor all users until they are fully capable of performing tasks in a safe manner. (This is particularly relevant in civil and mechanical engineering laboratories where use of any laboratory systems requires that at least two persons be present during the time of materials testing.)

Every year, faculty and staff are required to attend a safety briefing by the safety officer of the College of Science and Engineering, which covers health and safety issues in research and teaching laboratories. Engineering laboratory and research rooms are regularly inspected for safety violations, including obstructions, fire code violations, missing safety gear, etc. by the safety officer. There are also periodic inspections by the fire marshal of the City of San Francisco.
CRITERION 8: INSTITUTIONAL SUPPORT

A. Leadership

The School of Engineering functions in a collaborative and collegial environment. Faculty are intimately involved with most major decisions involving things like faculty/staff hiring, student advising, curriculum, and other matters related to the School of Engineering. Decisions are generally arrived at by consensus of the faculty, with the Director making the final decision.

The organizational structure of the program is as follows:

- Program Head of Civil Engineering: Tim D’Orazio
- Director of School of Engineering: Wenshen Pong
- Dean of College of Science and Engineering: Keith Bowman
- Provost and Vice President for Academic Affairs: Jennifer Summit
- President: Leslie E. Wong

The program head is an uncompensated position with a three-year term elected by members of the program faculty. The program head’s responsibilities are chiefly concerned with advising of transfer students, review of probationary contracts, and keeping program information material up to date. The program head meets roughly monthly with the program faculty to go over issues important to the program, such as curriculum, equipment and facility matters, and program needs.

The director of the School of Engineering is elected by the faculty on a three-year term and is responsible for budget, scheduling of classes and supervising hiring and staff. The director position, which is essentially equivalent to the chair of a department, is a 12 month appointment which provides roughly 75% of time for administrative work and 25% for advising, teaching and research. The director meets with the program heads about six times per semester to discuss and prioritize issues that impact each program and the School of Engineering. The director also hosts bi-weekly school meetings to ensure that faculty and staff are aware of any new or important university affairs and policies and are involved with decision-making process.

The School of Engineering is a unit of the College of Science and Engineering, which comprises nine departments: Biology, Chemistry and Biochemistry, Computer Science, Earth & Climate Science, Engineering, Geography and Environment, Mathematics, Psychology, and Physics & Astronomy. The Dean of the College of Science and
Engineering provides overall direction to the units, allocates funding based on budget and enrollments, and authorizes and approves faculty hiring, retention and promotion. The dean meets biweekly with the director of School of Engineering and the other department chairs, at which time the director can share his concerns and suggestions to ensure that the engineering programs are strongly supported and funded at the college level.

**B. Program Budget and Financial Support**

**B.1 Program budget and financial support**

The budget of the School is determined by the Dean of the College of Science and Engineering. It is a legacy budget that is updated annually from the previous year’s University and College budgets with some adjustments made for student demand. Other factors, such as the number of laboratory courses, supplies and services needs to carry out laboratory courses and the maintenance of instructional facilities, are also used in deciding the budget for the School of Engineering.

**Annual (recurring) budgets**: The annual budgets include faculty and staff salary, supply and service, faculty travel and equipment. In addition, the School of Engineering also receives budget augmentations from the dean’s office, based on enrollment demand every semester to offer extra lab sections or major courses. The main components of our instructional budget (2016-2017 academic year) cover the salaries of

- Faculty (tenure/tenure-track): $1,424,150
- Part-time lecturers: $561,575
- Graduate Teaching Instructors (GTAs): $50,331
- Supplies and services: $29,484
- Equipment: $8,679
- Travel: $4,755
- Communication: $2,614

Engineering also receives extra funding for equipment, which is offered annually by the University based on the needs and priority set by the College. Engineering has received over $145,604 in the 2016-2017 academic year to upgrade our equipment through this fund.

**Computer upgrade funds**: The University provides funds to replace faculty computers on a rolling basis, normally every 3 to 4 years. Faculty whose computers are scheduled for replacement may choose a PC or Mac laptop or desktop computer. All engineering faculty in the School of Engineering has been offered new computers in the past five years through this program.
Instruction funds for students: The School of Engineering receives average $5000 per year, funded by the Instructionally Related Activities (IRA) fund supported by the Academic Affairs to support student’s research projects. Although this is a merit-based competitive funding request, engineering has been awarded around $12,000 this academic year. It has significantly supported students in their senior design projects, ENGR 696 and 697. Additionally, the Dean's office also supported $3000 to help Civil Engineering capstone design project competitions this year.

Graduate teaching assistants: The budget of the School includes support of graduate teaching instructors (GTAs) in laboratories and graders for lecture courses upon the request of faculty instructors. While most lecture and laboratory courses are taught by full-time faculty, some sections of lower-division laboratory courses are taught by GTAs who are supervised by faculty. Laboratory courses in the School of Engineering that are assigned to GTAs include the following, which are taken by students in civil engineering: ENGR 101, 103, and 430.

B.2 Institutional support of teaching

Excellence in teaching is a critical mission of the School of Engineering.

CoSE Student Success Center: The college is in the process of establishing an expanded and elevated student advising operation. Using a combination of permanent and one-time money the advising staff for the college was increased from one staff member to five during the 2016-2017 academic year.

MESA Program: The MESA (Mathematics Engineering Science Achievement) Program in the School of Engineering at SFSU has a mission of recruiting students and enhancing the School’s retention rate for engineering students. The program has a director, one student assistant and a tutoring staff of three.

Student advising and mentorship: The CSU system-wide "Graduation Initiative 2025" seeks to increase graduation rates for all CSU students and to eliminate opportunity and achievement gaps. In conjunction with this initiative, SFSU and the College of Science and Engineering (COSE) has completed a detailed examination of curricular and advising practices. COSE is currently in the process of undertaking measures to improve the graduation and career outcomes of students in Engineering, Computer Science and other STEM disciplines within the college. These changes will include remodeling of advising center to provide offices and enhanced service spaces.

COSE and SFSU are also committed to hiring advisers and administrative staff to provide individualized mentoring, peer advising and group workshops to students and training to
faculty advisors. It is COSE’s goal to use the best practices of the existing Mathematics Engineering Science Achievement (MESA) program currently offered to a subset of students within engineering, and expand these services to all engineering and COSE students. SFSU and COSE have also partnered with CSU-Los Angeles College of Engineering, Computer Science and Technology (ECST) to implement a pilot program, MentorNet (http://mentornet.org/).

MentorNet is a successful online platform where students obtain support, one-on-one mentoring and career advising from matched professionals; MentorNet has been shown to be especially successful for students from underrepresented groups. COSE will also expand support for supplemental instruction for core math and science courses. Lastly, the COSE is working closely with student organizations to enhance communications and to identify student needs. These organizations include student leaders from SHPE (Society of Hispanic Professional Engineers), NSBE (National Society of Black Engineers), ASME (America Society of Mechanical Engineers), SWE (Society of Women Engineers), IEEE (Institute of Electrical and Electronics Engineers), ACM (Association of Computing Machinery) and SACNAS (Society for the Advancement of Chicanos and Native Americans in Science).

The Center for Equity and Excellence in Teaching and Learning (CEETL), (https://senate.sfsu.edu/policy/charge-center-equity-and-excellence-teaching-and-learning-ceetl) provides a number of resources to aid faculty in their research, scholarly activities, and creative endeavors. It also can help with curriculum development, instructional skills development and pedagogy. The CEETL organizes workshops on effective teaching techniques, technology and multi-media use in the classroom, and provides training in various computer software, web-page design, on-line teaching and learning, and other subjects to help faculty members become better and more effective teachers. The CEETL is equipped with high-end hardware and software, and provides faculty familiarization with state-of-the-art technology. Many engineering faculty have attended these workshops.

Computer training and software: The University has negotiated site licenses for commonly used software such as Microsoft Windows and Office and makes this available to faculty at no charge through the University’s Division of Information Technology Central (http://tech.sfsu.edu/). Technology Central also hosts a Technology Training Center that offers online and, budget permitting, workshops and courses on topics such as

- Basic Computers using Mac OS and Windows
- Web site development using Dreamweaver and HTML
- Computer graphics and layout using Photoshop and Illustrator
• Data analysis using Access and SPSS
• Word processing using Word
• Spreadsheets using Excel
• Presentations using PowerPoint

Students are able to buy computer hardware and software at highly discounted process through the University bookstore (http://www.bkstr.com/sanfranciscostatestore/home).

Academic Technology (http://at.sfsu.edu/) provides technology to improve and enhance teaching. They provide

• Creative Services. Faculty can order media to meet their classroom instructional needs, including digital video and photography, computerized graphics, and virtual environments. Video streaming, video conferencing, and teleconferencing are also supported in this area.
• Classrooms. Academic Technology currently oversees and maintains 100 enhanced classrooms, six enhanced meeting rooms, and two enhanced theaters. They plan, design, build, install, and maintain instructional electronic equipment throughout the campus.
• Media Distribution and Support provides faculty with formatted media and technical equipment to meet their classroom and other instructional purposes. The university media collection includes over 20,000 videotapes, DVDs, laserdiscs, CD-ROMs, films, and multimedia kits.
• Online Teaching and Learning. Academic Technology leads and coordinates development, training, and support for several different online teaching and learning tools, including iLearn, courseStream and others.
• Workshops and Tutorials on use of various technologies supported by Academic Technology.

Faculty use Academic Technology’s creative services to create media to meet their classroom instructional needs using a wide variety of resources, including digital video and photography, computerized graphics, and virtual environments. This media is used to develop self-teaching videotape modules, distance education on-line courses, multimedia packages, and Power Point classroom presentations. Continuing support for faculty using slides, overhead transparencies, and charts is available. Video streaming, video conferencing, and teleconferencing are also supported in this area.
B.3 Infrastructure, facilities and equipment

The College of Science and Engineering and the University continues to provide funds for special infrastructure projects that benefit the faculty and students of the School of Engineering and allow us to achieve our program objectives.

Since the last accreditation, the College of Science and Engineering has materially assisted in the refurbishment and renovation of three teaching and research laboratories in the Science building that are expressly for the use of faculty and students in civil engineering. Since the Science building is one of the older buildings on campus, repurposing of existing rooms to new functions can require structural alterations and abatement of hazardous materials, as well as provision of additional power. The following are details of the improvements:

- SCI-113 (Structural Engineering Laboratory). This laboratory is led by Prof. Cheng Chen. The objective of the Structural/Earthquake Laboratory is to provide students with demonstrations of structural responses to loads and to educate them in experimental methods for measuring these responses. Students are expected to learn through hands-on experiments to verify the theoretical, analytical and design principles presented in lectures on structures.

- SCI-153 (Intelligent Structural Hazards Mitigation Laboratory): This laboratory is led by Prof. Zhaoshuo Jiang. This laboratory serves Civil Engineering students for their research activities in multi-hazard mitigation (e.g. earthquake and hurricane), structural control and structural health monitoring. The objectives of this laboratory are to provide techniques and equipment to train students in structural engineering and to explore the performances of structure systems under natural hazards using state-of-the-art technologies.

- SCI 155 (Advanced Materials research Laboratory). This laboratory is led by Prof. Kwok-Siong Teh. The Advanced Materials Research Laboratory (AMRL) is a research laboratory dedicated to materials science and engineering research. In particular, the laboratory focuses on developing low-cost, environmentally friendly and additive manufacturing techniques for synthesizing and characterizing energy materials for electrochemical energy storage and light-weight fiber-reinforced composites.

- SCI 251 (Civil Engineering Laboratory for Senior Design Project): This laboratory is led by Prof. Cheng Chen. This laboratory was established in 2016 to support undergraduate civil engineering students for their senior design projects. The lab is equipped with computers installed with Matlab and SAP2000 as well as a laser cutter machine specifically for the students participating in the seismic design competition organized by the Earthquake Engineering Research Institute (EERI).
• SCI 253 (Civil Engineering Structural Laboratory for Multi-Hazard Mitigation): This laboratory is led by Prof. Cheng Chen. This laboratory serves both undergraduate and graduate civil engineering students for their research activities in natural hazard mitigation for earthquakes and fires. In particular, this laboratory focuses on computational analysis of civil engineering infrastructure under natural hazards to enhance safety and sustainability of human society.

The College and University provided all the funding for these renovations and also provided all the architectural work and project management. The work was coordinated by the director of operations of the College of Science and Engineering.

• Proposed new Science Building. Although a final design has not been commissioned, planned or approved, pending approval of funding, a new building will be planned and constructed in the northeast quadrant of the SFSU campus. A feasibility study was completed by Skidmore, Owings and Merrill, LLC. This resulted in the recommendation of a building of 158,000 sq. ft. A preliminary design was also provided. Among some of the guiding principles in the preliminary design were included:

  Connect 19th Ave. gateway and the local community to the rest of the SFSU campus.

  Create a 21st century learning environment.

  Provide students with a space that also enhances creativity, innovation, and human wellness.

  Provide a flexible learning design.

  Meet energy and sustainability goals.

B.4 Adequacy of resources

The resources described in this document are adequate to allow students to achieve the student outcomes.

C. Staffing

The School of Engineering has adequate support personnel and the institutional services to achieve its educational objectives, as described in the following paragraphs
Staffing of the program

The School of Engineering has two full-time technical staff members and three student assistants. Both of the technical staff members have degrees in engineering and both are completely familiar with the School of Engineering, having graduated from the School.

Technical staff: The technical staff is responsible for providing technical support to School of Engineering, for both teaching and research programs. They have multiple responsibilities: they design, fabricate and repair specialized equipment and instruments; assemble, test and maintain equipment setups in various engineering instructional laboratories, plan and execute repairs and improvements for existing facilities equipment and supervise student assistants in the stockroom. Nominally, one technician services the electronic equipment, computers, printers and other electronics products and the other technician services mechanical equipment such as universal testing machines, pumps and motors. Each has a comprehensive knowledge of the methods, materials, tools and equipment used in the construction, installation, maintenance, repair and operation of equipment in their area of specialization. The senior of the two technicians has responsibility for managing the stockroom and also provides most of the support for ordering equipment and supplies necessary for the laboratories.

In addition to the permanent staff, there are three student assistants who work in the stockroom to keep the stockroom window hours fully staffed during academic semester and assist with the maintenance of equipment and facilities and the set-up of the laboratories under the supervision of the technicians.

The process of hiring staff is initiated by a search committee formed from faculty members of civil, electrical and mechanical engineering, and the director of School of Engineering. The search committee solicits opinions of the faculty and comes up with a position description which is posted on the university website. The search committee reviews all applications, and the top three to five candidates are invited for a campus interview. The search committee identifies the acceptable candidates to dean of College of Science and Engineering who also takes input from faculty on hiring priorities within the search pool. Review and retention of staff is governed by University policies. Newly hired staff members are reviewed every three months during their first one-year probationary after which they are retained. The performance of staff members is also reviewed on the yearly basis once they are retained.

Office staff: The School of Engineering has two office staff members. The academic office coordinator oversees the administrative functions of the office. The administrative support coordinator assists and advises students and support faculty. There are two
student assistants working in the engineering office, who assist in office matters during the academic semester.

**Institutional Services:**

The School of Engineering has available to it several sources of institutional support from the College of Science and Engineering and the University.

The College of Science and Engineering provides a number of institutional services to the School of Engineering.

**Dean’s office:** The dean’s office assists in most human resources related matters. The College also has professional staff to assist in faculty travel, classroom scheduling and financial management matters.

**Science service center:** The Science Service Center, located within the College of Science and Engineering provides help in maintenance of equipment and instrumentation of our School. The center’s technicians and machinists also help directly with the fabrication of parts for student projects.

**Network analyst:** The Network Analyst of the College of Science and Engineering provides administrative help with the Unix-based server that run Cadence software. All other computer laboratories within the university are maintained by the Academic Computing Center.

The University provides substantial resources to the School including the following:

**Technology Central:** The University’s Information Technology Services provides both hardware and software support to the campus wide. The Network and Telecommunications group provides all the phone and Internet support for the campus, including the campus-wide wired and wireless network, and is responsible for all the maintenance and upgrade of all mail servers. Information Technology Services (ITS) maintains a help line to assist faculty and students in resolving hardware and software problems (e.g. software configuration, connection issues). ITS also provides training for faculty and students on a range of software products.

**Library:** The University maintains the library and also provides specialized assistance to the School of Engineering in the form of a designated reference librarian who is responsible for acquisitions of materials requested by the faculty and students of the School. Details of the University’s library services are found http://library.sfsu.edu/.

**Office of International Programs:** The Office of International Programs (http://oip.sfsu.edu/) provides campus-wide leadership and coordination in implementing
the university's goals for international education and exchange. It works closely with faculty, staff, students, scholars, the local community, and international alumni in supporting initiatives to internationalize the campus.

D. Faculty Hiring and Retention

D.1 Faculty hiring

The hiring of new faculty in the School of Engineering is governed by a formal policy spelled out in the document, “Hiring Policy of the School of Engineering”. This policy was crafted by a committee of the faculty through a deliberative process which received input from the faculty and director, and was ratified by faculty vote. The most updated policy was approved in 2015. The end result of a successful search is an offer from the dean of the College. In brief:

- The need for a new faculty position is formulated by the director and the program in which the position will reside, and forwarded to the dean. The designated program in which the candidate will reside has primary responsibility for specifying the position, though more than one program may be involved in the case of an appointment of common interest to more than one program. For example, our newest both the mechanical and electrical programs collaborated on our recent successful search for a new faculty member in mechanical engineering with a specialty in control systems and mechatronics, which are areas of common interest of the two programs. The position description is reviewed by the director of the school and is approved the dean of the college before being posted.

- When the position has been approved by the dean and provost, the hiring committee is constituted. Each position has its own search committee.

- The hiring committee consists of all tenure and tenure-track members of the program in which the position will reside. The hiring committee is responsible for the evaluation and screening of candidates who respond to the position postings. They review and rank resumes, contact a subset of the most qualified applicants by phone and e-mail, and recommend to the director and the dean those candidates who should be invited to the school for on-campus interview.

- Following the visits of all candidates, the hiring committee makes its recommendations to the director. The director evaluates the recommendations of the search committee within the context of the overall needs and resources of the School and writes a letter to the dean for further action. The dean makes the offer to a candidate and negotiates details of the hire, such as the size of the start-up package and laboratory space that will be provided. In the past ten years six engineering faculty have been hired and one of those new hires has since left for another institution. The startup package commitments for these six new hires, which include
funds for discretionary spending on travel, equipment, supplies and student support, total nearly $800,000. In addition, the college has committed nearly ten months of junior faculty summer support and a total of 72 semesters of teaching release.

D.2 Faculty retention

The retention, tenure and promotion policies of the School of Engineering are strictly in accordance with the University policies that govern these matters. These policies are articulated in a number of places, particularly in the Retention, Tenure and Promotion Policy of the Academic Senate (AS #S16-241, http://senate.sfsu.edu/policy/retention-tenure-and-promotion). This policy details how Retention, Hiring and Promotion (RTP) committees are to be constituted, the general principles for their operation, and general guidelines for developing and applying each department’s RTP policies.

The RTP polices of the School of Engineering for evaluating candidates for retention, tenure and promotion are laid out in a document “Criteria for Retention, Tenure and Promotion”, which was most updated/adopted by the faculty in 2012. The RTP committee of the School of Engineering is elected by the faculty at large. It consists of five members and comprises at least one faculty member from each program. The criteria for retention, tenure, and promotion are divided into three areas:

- Teaching effectiveness. Teaching effectiveness is measured by student evaluations of the candidate’s classroom teaching performance, which contain both numerical and anecdotal information. These are conducted every term for provisional faculty members. The RTP committee also commissions and reviews letters of evaluation from tenured faculty members who are sent to observe a candidate’s classroom teaching. The committee also considers curricular innovations, advising of undergraduate and graduate student candidate and other factors.
- Professional achievement and growth. The RTP committee considers the candidate’s publication record, including journal and conference publications, reports, books and monographs. It also considers grants, funded and unfunded, laboratory development, research work and other creative work, awards and recognition and professional consulting work.
- Contributions to campus and community. In this category, the RTP committee considers service to the School, the University and the profession. Examples of service to the School and University include service on committees, liaison with alumni or industry, outreach activities and representation of the School or University at special events. Service to the community comprises anything that enhances the
relations between the community at large and the University or the profession. Service to the profession includes membership or leadership in committees of professional organizations, organization of conferences or symposia related to engineering research and/or education and participation on editorial boards and conference program committees.

Each candidate maintains a Working Personnel Action File (WPAF), which is basically an indexed binder that records the candidate’s achievements in each of these three areas, including appropriate supporting documentation. Probationary faculty members are reviewed every year. The nature of the information required by the RTP from the candidate in each year of review as well as the schedule of the committee’s requests and the faculty member’s responses are determined by the University RTP Calendar. Reports of the RTP committee go to the candidate and the director of the School of Engineering. The report can include suggestions and recommendations to the candidate for improvements and also gives the committee’s recommendation for retention. The director forwards the RTP report to the dean with his/her own recommendation, who forwards it to the provost and thence to the president who makes the final decision to retain. The sixth year marks the terminal year of probation and the RTP must either vote to retain the candidate with tenure or allow a final year of service.

Despite the formal, somewhat scripted nature of the RTP process, we should emphasize that the yearly review process is designed to help probationary faculty members understand the expectations of the department and get feedback from the committee on the extent to which they are meeting those expectations. It also allows candidates to showcase their achievements and share their concerns. To the extent possible, it is the policy of the School of Engineering to “hire to keep”. That means that we go through great lengths to choose the right candidate in the first place, one who matches the requirements and the spirit of the School of Engineering. Then we work with the candidate throughout the probationary years to navigate the RTP process effectively and to help them fulfill their promise as teachers and researchers.

E. Support of Faculty Professional Development

The School of Engineering, the College of Science and Engineering and the University provide numerous resources that support faculty development.

Faculty startup packages: The dean of the College of Science and Engineering provides each newly hired faculty member with a start-up fund of approximately over $100,000 for research and professional development. Each of the five faculty members hired by the School of Engineering since the last accreditation has received such a package. Faculty
may use this fund to purchase equipment and supplies, and can continue to draw upon it, as needed, for several years after joining SFSU.

**Faculty teaching load:** Newly hired faculty receive a reduced teaching load (six units instead of 12 units) for the first five years of appointment, three units of which come from the College dean and the other three from the School director. The intent of this reduced load is to allow faculty the time to prepare their lectures and to set up their research laboratory and to write and submit proposals for extramural funding of their research. Faculty can “buy out” a portion of their teaching load by bringing in reimbursed released time fund to cover the replacement cost of a part-time lecturer or instructor. However, since excellence in teaching is still a core component of the School of Engineering, it is expected that faculty will teach no less than two courses per semester.

**Faculty grants:** The University offers competitive faculty travel grants to support faculty in their scholarly activities in attending conferences and professional meetings. Each faculty member can receive up to $1500 per year from the Office of Academic Affairs for attending conferences. The University also offers many internal grant opportunities, such as development of research and creativity awards and presidential awards for probationary faculty.

**ORSP:** The Office of Sponsored Research Programs (ORSP) is the main avenue for faculty applying for extramural funding (http://research.sfsu.edu/). The ORSP provides pre-award as well as post-award assistance to all faculty. Their pre-award services include finding funding opportunities, developing, writing and budgeting research proposals. Post-award services include management of accounts and providing financial reports. The Associate Vice President for Research and Sponsored Program (ORSP) can also provide release time, bridge grants, and small grants for equipment and student stipends as the seed money for faculty to develop proposals.

The School has actively encouraged its faculty to submit proposals to the National Science Foundation, NASA Education, Department of Education, Department of Energy, and other private companies in order to receive funds to equip instructional laboratories and help faculty to develop state-of-the-art laboratories. The School of Engineering faculty has brought in more than $7,000,000 worth of projects in 2011-2016 years from private companies, the State of California, and the Federal government. These are summarized in Table 8.1. For example, the National Science Foundation (NSF) has awarded four Major Research Instrumentation grants in the amount of over $1.2 million to the School of Engineering since 2010. The School of Engineering has received collaborative funding grants from Department of Education through its HSI-STEM and Minority Science and Engineering Improvement Program (MSEIP) to help increase retain community college students in engineering since 2011.
Table 8.1 Summary of grants 2011-16

<table>
<thead>
<tr>
<th>Granting Agency</th>
<th>PI</th>
<th>Amount</th>
<th>Term</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altera Inc</td>
<td>Ahmad Ganji</td>
<td>$4,990</td>
<td>4/2012-4/2013</td>
<td>Digital System Design Lab</td>
</tr>
<tr>
<td>Department of Energy</td>
<td>Ahmad Ganji</td>
<td>$1,000,000</td>
<td>2011-2016</td>
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<tr>
<td>DOE Pacific Region Clean Energy</td>
<td>Ahmad Ganji</td>
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<td>2011-2013</td>
<td></td>
</tr>
<tr>
<td>Department of Energy</td>
<td>Ahmad Ganji</td>
<td>$1,250,000</td>
<td>2016-2021</td>
<td></td>
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<tr>
<td>NSF-BRIGE Grant</td>
<td>Cheng Chen</td>
<td>$171,825</td>
<td>2012-2015</td>
<td>BRIGE: Reliability Assessment</td>
</tr>
<tr>
<td>NSF-MRI Grant</td>
<td>Cheng Chen</td>
<td>$246,454</td>
<td>2011-2014</td>
<td>MRI: Hydraulic structure test system</td>
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<td>Small Grant Award, ORSP, SFSU</td>
<td>Cheng Chen</td>
<td>$14,796</td>
<td>2014-2015</td>
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<tr>
<td>Small Grant Award, ORSP, SFSU</td>
<td>Cheng Chen</td>
<td>$8,500</td>
<td>2013-2014</td>
<td></td>
</tr>
<tr>
<td>Wang Family Faculty Award, CSU</td>
<td>Cheng Chen</td>
<td>$10,000</td>
<td>2012-2013</td>
<td></td>
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<tr>
<td>California Air Resource Board</td>
<td>Ed Cheng</td>
<td>$199,000</td>
<td>2014-2016</td>
<td></td>
</tr>
<tr>
<td>Microsoft</td>
<td>Hamid Mahmoodi</td>
<td>$25,000</td>
<td>12/2014-12/2015</td>
<td>Workshop on Smart Cities</td>
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<tr>
<td>DARPA</td>
<td>Hamid Mahmoodi</td>
<td>$60,000</td>
<td>7/2015-7/2016</td>
<td>CMOS Technology</td>
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<tr>
<td>SF City Office of Economic and Workforce Development (OEWD)</td>
<td>Hamid Mahmoodi</td>
<td>$300,000</td>
<td>1/2013-6/2015</td>
<td>Project Based Learning</td>
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<tr>
<td>National Science Foundation</td>
<td>Hamid Mahmoodi</td>
<td>$263,000</td>
<td>2010-2013</td>
<td></td>
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<tr>
<td>National Science Foundation</td>
<td>Hao Jiang</td>
<td>$279,537</td>
<td>2015-2018</td>
<td>MRI: Network Analyzer</td>
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<td>CSU DRC Grant</td>
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<td>$8,000</td>
<td>2016-2017</td>
<td>Frequency Programmable Circuits</td>
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<tr>
<td>Funding Source</td>
<td>Investigator(s)</td>
<td>Amount</td>
<td>Start Date</td>
<td>End Date</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>-----------------------</td>
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<tr>
<td>SFSU CCLS Mini Grant</td>
<td>Hao Jiang (co-PI)</td>
<td>$6,000</td>
<td>2015-2016</td>
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<td>Air Force Office of Scientific Research (AFOSR)</td>
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<td>$6,000</td>
<td>2016</td>
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<tr>
<td>Summer Faculty Fellowship Program (2016 SFFP)</td>
<td>Hao Jiang</td>
<td>$6,000</td>
<td>2015</td>
<td></td>
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<tr>
<td>Air Force Office of Scientific Research (AFOSR)</td>
<td>Hao Jiang</td>
<td>$6,000</td>
<td>2014</td>
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<tr>
<td>Summer Faculty Fellowship Program (2015 SFFP)</td>
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<td>$6,000</td>
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<tr>
<td>National Science Foundation Major Research Instrument Grant</td>
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<tr>
<td>SFSU DRC</td>
<td>Jin Ye</td>
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<td>2016</td>
<td>2016</td>
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<tr>
<td>NSF EPMD</td>
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<tr>
<td>American Chemical Society's PRF UNI grant</td>
<td>Kwok-Siong Teh</td>
<td>$50,000</td>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>SFSU Center for Computing for Life Sciences (CCLS) Mini Grant</td>
<td>Mojtaba Azadi</td>
<td>$4,000</td>
<td>2016-2017</td>
<td></td>
</tr>
<tr>
<td>National Science Foundation</td>
<td>Mojtaba Azadi</td>
<td>$472,818</td>
<td>2016-2019</td>
<td></td>
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<tr>
<td>NSF-satem</td>
<td>Wenshen Pong</td>
<td>$600,000</td>
<td>2009-2013</td>
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<tr>
<td>U.S. DOE Minority STEM</td>
<td>Wenshen Pong</td>
<td>$183,000</td>
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<td>U.S. DOE HIS-STEM</td>
<td>Wenshen Pong</td>
<td>$750,000</td>
<td>2011-2016</td>
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<tr>
<td>NASA-CiPair</td>
<td>Wenshen Pong</td>
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<td>2010-2013</td>
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<tr>
<td>SFSU Center for Computing for Life Sciences (CCLS) Mini Grant</td>
<td>Xiaorong Zhang</td>
<td>$1,000</td>
<td>2016-2017</td>
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<tr>
<td>SFSU Center for Computing for Life Sciences (CCLS) Mini Grant</td>
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<tr>
<td>CSUPERB Faculty-Student Collaborative Research Grant</td>
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<tr>
<td>CSUPERB Faculty-Student Collaborative Research Grant</td>
<td>Xiaorong Zhang</td>
<td>$20,000</td>
<td>2016-2017</td>
<td></td>
</tr>
<tr>
<td>SFSU Ken Fong Translational Research Fund</td>
<td>Xiaorong Zhang</td>
<td>$20,000</td>
<td>2016-2017</td>
<td></td>
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<tr>
<td>IDEA Impact Center</td>
<td>Zhaoshuo Jiang</td>
<td>$9,400</td>
<td>2017-2018</td>
<td></td>
</tr>
<tr>
<td>Quanser Inc</td>
<td>Zhaoshuo Jiang</td>
<td>$129,000</td>
<td>2016-2019</td>
<td></td>
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<tr>
<td>SFSU ORSP</td>
<td>Zhaoshuo Jiang</td>
<td>$12,500</td>
<td>2016-2017</td>
<td></td>
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<tr>
<td>Kern Family Foundation</td>
<td>Zhaoshuo Jiang</td>
<td>$2,750</td>
<td>2016-2017</td>
<td></td>
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<tr>
<td>CSU Chancellor’s Office</td>
<td>Zhaoshuo Jiang</td>
<td>$17,966</td>
<td>2016-2017</td>
<td></td>
</tr>
</tbody>
</table>
PROGRAM CRITERION

For reference, the civil engineering program criterion is:

1. Curriculum
   The program must prepare graduates to apply knowledge of mathematics through
differential equations, calculus-based physics, chemistry, and at least one additional
area of basic science; apply probability and statistics to address uncertainty; analyze
and solve problems in at least four technical areas appropriate to civil engineering;
conduct experiments in at least two technical areas of civil engineering, and analyze
and interpret the resulting data; design a system, component, or process in at least two
civil engineering contexts; include principles of sustainability in design; explain basic
concepts in project management, business, public policy, and leadership; analyze
issues in professional ethics; and explain the importance of professional licensure.

2. Faculty
   The program must demonstrate that faculty teaching courses that are primarily design
in content are qualified to teach the subject matter by virtue of professional licensure,
or by education and design experience. The program must demonstrate that it is not
critically dependent on one individual.

The Civil Engineering program at San Francisco State University meets the program criterion.
Each item in the criterion and the evidence of meeting the criterion is described next. The order
is:

Curriculum

1. Mathematics, Physics, Probability and Statistics, Chemistry, and Additional area of basic
   science
2. Four technical areas of civil engineering
3. Civil engineering experimentation
4. Civil engineering design including sustainability
5. Management, business, public policy, leadership, ethics and professional licensure

Faculty

1. Faculty teaching design courses
2. Not dependent on one individual
Mathematics, Physics, Probability and Statistics, Chemistry, and Additional area of basic science

1. Mathematics, Probability and Statistics – Students are required to take Calculus I, II, and III, Linear Algebra and Differential Equations. This amounts to a total of 15 semester units of mathematics. All classes are offered by the Mathematics Department. Probability and Statistics is covered in ENGR 300 (Engineering Experimentation – 3 units). Students are required to use the mathematics in their engineering classes. This is described in detail in the rest of this section of the self-study.

2. Physics – Students are required to take a 3-class physics sequence known as Physics I, II, and III. Each course has a laboratory class associated with it. The lecture portion of each class is 3 units and the laboratory portion is 1 unit. This makes 12 units of required physics. The prerequisite for the physics classes is calculus. All the physics is calculus based. Physics is a prerequisite for civil engineering classes. Students are required to use the physics in their engineering classes. This is described in detail in the rest of this section of the self-study.

   a. Physics I (Mechanics) is a prerequisite for ENGR 102 (Statics), which is a prerequisite for ENGR309 (Mechanics of Materials), which is a prerequisite for ENGR 323 (Structural Analysis), which is a prerequisite for all our structural engineering design classes.

   b. Physics II (Electricity and Magnetism) is a prerequisite for ENGR 205 (Circuit analysis), which is a prerequisite for ENGR 300 (Engineering Experimentation), which is a prerequisite for ENGR 302 (Experimental Analysis)

   c. Physics III (Thermodynamics and Wave mechanics) is a prerequisite for ENGR 304 (Fluid Mechanics) which is a prerequisite for ENGR 434 (Principles of Environmental Engineering).

3. Chemistry – Students are required to take college Chemistry (Chem 180, Chemistry for Energy and the Environment) for chemistry. This course is 3 semester units and includes a laboratory. This is a class for Engineering and Environmental Science majors. This class is a prerequisite for ENGR 200 (Materials of Engineering) and ENGR 434 (Principles of Environmental Engineering).

4. Additional area of basic science – Students are required to take a Biological Science course as part of General Education requirements. This course has no prerequisites and is not a prerequisite for any course in Engineering.
This table summarizes the courses.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics (15 units)</td>
<td>Graphs, differentiation, integration, analytic geometry, vectors, sequences, series, differential equations, and linear algebra</td>
</tr>
<tr>
<td>(Math 226, 227, 228, 245)</td>
<td></td>
</tr>
<tr>
<td>Calculus-based Physics (12 units)</td>
<td>Mechanics with lab, electricity and magnetism with lab, wave motion, optics and thermodynamics with lab.</td>
</tr>
<tr>
<td>(Phys 220, 222, 230, 232, 240, 242)</td>
<td></td>
</tr>
<tr>
<td>Probability and statistics (3 units)</td>
<td>Basic concepts and methods of probability and statistics. Statistics applied in interpreting laboratory test results.</td>
</tr>
<tr>
<td>(ENGR 300)</td>
<td></td>
</tr>
<tr>
<td>Chemistry (3 units)</td>
<td>Chemical principles, chemical processes, energy, atomic structure, properties of molecules (structure, bonding geometry, polarity) with lab.</td>
</tr>
<tr>
<td>(Chem. 180)</td>
<td></td>
</tr>
<tr>
<td>Biological Science (3 units)</td>
<td>Students take a biological science, which includes health science or other life science required for general education.</td>
</tr>
</tbody>
</table>

**Use of These Topics in the Civil Engineering Curriculum**

Examples of the use of these skills in the civil engineering curriculum are provided in the discussion below.

**Mathematics**

Mathematical skills are deeply integrated into the civil engineering curriculum. Engineering Statics (ENGR 102), one of the first engineering courses, uses integration in determining centroids and moments of inertia. Vectors are used throughout the course in representing force systems. Engineering Dynamics (ENGR 201) makes heavy use of integral and differential calculus. In ENGR 300 (Engineering Experimentation), graphing is important for students to interpret their data. In ENGR 309 (Mechanics of Materials), differentiation and integration are used in developing shear and bending-moment diagrams, and the double integration method is used in solving the differential equation for deflection of beams. The buckling differential equation is also solved in this course. Analytic geometry is used in creating and evaluating Mohr’s circle of stress. In ENGR 235 (Surveying), analytic geometry methods are used for closing traverses and in leveling circuits. In ENGR 436 (Transportation Engineering), analytical geometry is used to design horizontal and vertical curves as well as roadway alignment. In ENGR 430 (Soil Mechanics), the Laplace differential equation is used for flow of
water through soils. Also, differential equations are used for determining the time rate of consolidation.

**Calculus-Based Physics**

Mechanics is the primary topic in physics used in civil engineering. The core sequence of courses – Statics, Dynamics, Mechanics of Materials, Structural Analysis, and Soil Mechanics – all require considerable student work in mechanics. Elective structural engineering classes such as ENGR 425 (Concrete Design), ENGR 426 (Design of Steel Structures), ENGR 427 (Design of Wood Structures), ENGR 461 (Engineering Vibrations), and ENGR 431 (Foundation Engineering) all use the mechanics taught in physics. The physics topic of thermodynamics is used in ENGR 304 (Fluid Mechanics) and ENGR 434 (Environmental Engineering) in interpreting and developing treatment processes and using control volumes to analyze problems.

**Probability and Statistics**

Probability and statistics are covered in ENGR 300 (Engineering Experimentation). There, the fundamental axioms of probability are covered as well as basic methods of statistical analysis. Students apply the knowledge in the laboratory portion of the course in terms of such things as curve fitting of data and in hypothesis testing. In ENGR 235, (Surveying) students assess precision, accuracy, and occurrence of random errors in measurements. Risk of structural failure is discussed in ENGR 425 (Reinforced Concrete Structures) and ENGR 426 (Steel Structures). Stochastic Scheduling (PERT and Monte Carlo simulation) is included in ENGR 429 (Construction Management). Concepts from Probability and Statistics are also used in Experimental Analysis (ENGR 302), Reinforced Concrete Structures (ENGR 425), Environmental Engineering (ENGR 434), and Engineering Cost Analysis (ENGR 610).

**Chemistry**

In ENGR 200 (Materials of Engineering), students use basic chemical principles in metallurgy and metallurgical processes. In ENGR 430 (Soil Mechanics), atomic structure is used in describing clay minerals. In ENGR 434 (Sanitary and Environmental Engineering), students use properties of molecules, structure and reactions to develop the water treatment reactions. Organic chemistry is also used in wastewater treatment.

**Four Technical Areas of Civil Engineering**

The Civil Engineering curriculum provides graduates with the ability to apply knowledge in four areas: construction management, environmental engineering, geotechnical engineering, and structural engineering. We believe that undergraduate students have the ability to apply knowledge in a particular area when they have met these criteria:
1. They understand the scope of the area.

2. They are knowledgeable about the basic concepts in the area.

3. They are aware of the standards of practice.

4. They are able to apply the concepts and standards to practical problems.

The discussion below provides definition, implementation, and evidence of ability to apply knowledge in each of the four areas in our curriculum.

1. Construction Management Definition

Construction management deals with the processes employed in transferring a designed civil engineering project into a constructed project. These processes encompass all the phases of the construction process starting with the contractual arrangements and ending with the project delivery. The objective of construction management is to deliver projects on time and within budget without compromising safety and/or quality.

The basic concepts in construction management are:

- Contractual relationships in construction
- Construction contracts
- Characteristics of the construction industry
- Cost estimating
- Project planning and scheduling (CPM, PERT, etc.)
- Resource management
- The impact of project time reduction on project cost
- Construction safety

There are no specific standards or codes that must be followed in construction management. However, engineers practicing construction management are expected to utilize the resources available in this field. These resources include guides for cost estimating such as the Means Building Construction Cost Index; scheduling tools such as arrow and precedence diagrams, the output of CPM computations, and scheduling computer applications commonly used in the
construction industry. Furthermore, engineers practicing in this field are expected to be familiar with the role of OSHA in construction safety and some of the resources available at OSHA.

**Implementation**

Construction Management (ENGR 429) is the primary course for developing knowledge and skill in the area of construction management. This course is a junior-level course that builds on the experience gained by the students in the courses taken before and during the junior year. The prerequisite course is Surveying (ENGR 235) where students learn about surveying measurements and measurement calculations. Students interested in gaining additional experience in construction management have the option of taking a senior level elective in Construction Engineering (ENGR 439) where they gain experience in construction equipment, construction methods and systems, and a more advanced understanding of construction safety.

**Evidence of ability to apply knowledge in Construction Management**

The primary evidence is the successful completion of Construction Management (ENGR 429). Evidence of course content and student work can be seen in the course portfolio (available at time of visit). We also offer an elective course in the construction area – Construction Engineering (ENGR 439).

**2. Environmental Engineering Definition**

Environmental engineering is manifest by sound engineering thought and practice in 1) the provision of safe and ample public water supplies; 2) the proper disposal or recycling of wastewater and solid wastes; 3) the safe drainage of urban and rural areas; 4) the control of water, soil, and atmospheric pollution; and 5) the social and environmental impact of these solutions. Furthermore, environmental engineering is concerned with engineering problems in the field of public health, such as control of arthropod-borne diseases; the elimination of industrial health hazards; the provision of adequate sanitation in urban, rural, and recreational areas; and the effect of technological advances on the environment.

The concepts basic to environmental engineering are the following:

- Mass balance
- Momentum balance
- Energy balance
- Transport Phenomena (Momentum, heat, and mass transfer)
Environmental engineering is a regulatory-driven discipline. The design of the treatment processes are carried out to meet the various federal, state, and local standards for drinking water, wastewater, air, solid, and hazardous waste. Because of the wide variations in the nature of state and local regulations, only United States Environmental Protection Agency’s (USEPA) regulations are emphasized in the introductory course. These are USEPA primary and secondary drinking water standards as well as USEPA wastewater treatment standards.

**Implementation**

Principles of Environmental Engineering (ENGR 434) is the primary course for developing knowledge and skill in environmental engineering. It builds on Chemistry for Energy and the Environment (Chem. 180) and Mechanics of Fluids (ENGR 304). The chemistry course prepares students through its introduction of the fundamentals of chemical compounds, concentrations, law of mass action, chemical equilibrium, and solubility. Fluid mechanics prepares students through its focus on the basic concepts of continuity of mass and energy equations. Environmental Engineering (ENGR 434) then builds on this knowledge to teach students the concepts of energy loss and friction necessary to an understanding the effect of fluid flow in pipes in the design of piping networks. In order to understand the fundamentals of water treatment design taught in ENGR 434, a knowledge of basic fluid laws such as Stokes law is required. Further knowledge of Environmental Engineering can be attained by taking Environmental

**Evidence of knowledge and skill in Environmental Engineering.**

The primary evidence is the successful completion of Environmental Engineering. Evidence of course content and student work can be seen in the course portfolio (available at time of visit).

**3. Geotechnical Engineering Definition**
Geotechnical engineering encompasses these important topics: determining soil properties (including strength, stiffness, compaction characteristics, susceptibility to liquefaction, and permeability); site investigation and evaluation (including developing a site soil profile); analysis and design of earth structures (including embankments, earth dams, landfills, and natural slopes); evaluation of fluid flow in soils; analysis and design of earth retaining structures; and analysis and design of foundations for structures. Fundamental to any evaluation in geotechnical engineering is a proper assessment of soil properties, which in many cases involves laboratory or in-situ testing. The objective of the profession is to create efficient and safe earth structures, foundations and earth retaining structures and to evaluate the safety and performance of existing natural soil and earth structures to assure public safety.

The basic concepts in geotechnical engineering are the following:

- Soil mineralogy, grain size distribution and structure
- Compaction and water content effects on soil behavior
- Darcy’s law and the flow of water through soil
- Terzaghi’s consolidation theory
- Principal of effective stress
- Principles of liquefaction

The standards of practice are established through the efforts of geotechnical engineers working on design projects, analytical studies, and research projects. These efforts are reported in various civil and geotechnical engineering publications (e.g., ASCE Journal of Geotechnical and Geoenvironmental Engineering). The standards of practice are also influenced by the established procedures of organizations such as the Bureau of Reclamation, the US Nuclear Regulatory Commission, US Navy, Caltrans, and others. For soil testing, the ASTM standards govern practice in the U.S.

**Implementation**

Prior to studying geotechnical engineering, students must understand the concepts of static equilibrium, which are taught in ENGR 102 (Statics). Students must also know the fundamentals of material behavior, the concepts of stress, strain and failure, all of which are taught in ENGR 200 (Materials in Engineering). Stress analysis and Mohr’s circle of stress and strain are taught in ENGR 309 (Mechanics of Materials). Knowledge of all of these topics is necessary for a study of geotechnical engineering. Hence, all three of these courses are prerequisites for ENGR 430 (Soil Mechanics), which is the required class in geotechnical engineering. In ENGR 430, all of the above listed “Basic Concepts” are taught. These concepts are applied by students in developing compaction specifications, and analyzing the settlement of structures. Detailed design methods are not covered in ENGR 430 but in ENGR 431 (Foundation Engineering). ENGR 431 is an engineering elective course.
Evidence of ability to apply knowledge in Geotechnical Engineering

The primary evidence is the successful completion of Soil Mechanics. Evidence of course content and student work can be seen in the course portfolio (available at time of visit). A majority of the 2015 graduates elected to take Foundation Engineering (ENGR 431).

4. Structural Engineering Definition

Structural engineering encompasses the planning, designing, and construction of structures, such as, buildings, bridges and towers. Structural engineering activities may be directed toward construction of new structures or the rehabilitation of existing ones. The objective of the profession is to create structures that are economical and serve their intended purposes. The design and construction of structures is governed by concerns for public safety.

The concepts basic to structural engineering are the following:

- Static equilibrium
- Origin of loads
- Load paths through structures
- Minimum loads for public safety as specified by standards and codes
- Common configurations for structures
- Stability of structures
- Analysis for reactions, internal forces and deformations
- Design for strength and serviceability

The standards of practice are established through the efforts of structural engineers working on design projects, analytical studies, and research projects. These efforts are reported in various civil and structural engineering publications (e.g., ASCE Structural Journal, EERI Earthquake Spectra). In order to promote the advancement of the practice and to establish minimum standards, various professional engineering societies and governmental agencies develop standards and codes. An example of standards and codes used in structural engineering is the International Building Code.

Implementation

Instruction in structural engineering begins with Engineering Statics (ENGR 102), in which students learn to obtain reactions and internal forces using static equilibrium. The instruction continues in Mechanics of Solids (ENGR 309), adding more depth to students’ understanding of Statics as well as introducing them to analysis of deformations. ENGR 309 also
provides preliminary instruction in design for strength. Finally, Structural Analysis (ENGR 323) further develops student ability to apply knowledge in structural engineering. It expands on the concepts of analysis for reactions, internal forces and deformations. In addition, ENGR 323 presents determination of loads, structural stability, and basic concepts of design. Detailed methods for strength and serviceability are not covered in ENGR 323. They are covered in subsequent design courses taken by students wishing to develop a career in structural engineering.

Three structural design courses including, ENGR 425: Reinforced Concrete Structures (required course), ENGR 426: Steel Structures, and ENGR 427: Wood Structures, are offered to students focusing in the structural engineering area. ENGR 426 and ENGR 427 are highly recommended courses to fulfill the structural engineering focus. The Steel Structures course covers the Load Resistance and Factor Design (LRFD) design principles using the American Institute of Steel Construction (AISC) manual. The Reinforced Concrete course covers the Ultimate State Design (USD) method using the American Concrete Institute (ACI) manual. The Wood Structures course covers the Allowable Stress Design (ASD) method using National Design Specification (NDS) for wood construction. The Wood Structure course also covers Seismic Design Concepts using the IBC provisions, which introduce students to their first experience in structural design for earthquakes.

Evidence of ability to apply knowledge in Structural Engineering

The primary evidence is the successful completion of ENGR 323: Structural Analysis and ENGR 425: Reinforced Concrete Structures. Evidence of course content and student work can be seen in the course portfolios (available at time of visit).

Summary of Ability to apply Knowledge in Four Civil Engineering Areas

All students graduate with the ability to apply knowledge in four civil engineering areas as described above. The civil engineering curriculum requires students to take a sequence of courses culminating in Construction Management (ENGR 429), Environmental Engineering (ENGR 434), Soil Mechanics (ENGR 430), Structural Analysis (ENGR 323), and Reinforced Concrete Structures (ENGR 425)

In addition to this level, we advise that students gain a higher level of knowledge through selection of approved civil engineering electives. Students are advised to select courses from a pre-approved list in one of four focus areas. The courses on the list are assigned in order for students to attain a higher level of skill in a focus area while still maintaining knowledge in four areas.

Civil Engineering Experimentation
Our civil engineering graduates acquire the ability to conduct laboratory experiments and to critically analyze and interpret data in the areas of structural mechanics, soil mechanics and fluid mechanics. This ability is acquired through four courses: Materials of Engineering (ENGR 200), Engineering Experimentation (ENGR 300), Soil Mechanics (ENGR 430) and Experimental Analysis (ENGR 302).

In these labs, students conduct experiments according to a course syllabus or a laboratory write-up provided ahead of time. Before the start of each experiment, students participate in a discussion of the purpose for the experiments, followed by a demonstration of the experiments by the instructor. In order to encourage a deeper understanding of the purpose and methods, a quick exam is sometimes administered before the start of the experiments. The students form into groups to conduct the tests. This process promotes an understanding that experimentation often requires teamwork in conducting experiments and in collecting data.

In ENGR 200, 300, and 302, each student writes a separate lab report, which explains the experimental activities, reports the raw data, presents processed data (i.e. curves and charts), presents an analysis of the data, and finally interprets the results. The students must compare their findings with a theoretical value or a value obtained from a conventional method (depending on the type of the experiments) and discuss the deviations. ENGR 300 and 302 also include an open-ended project where the students design and build experiments for a specific purpose.

Students are required to conduct experiments and interpret and analyze the data in the following courses:

- ENGR 200 – Tensile test, Concrete test sample preparation, Concrete strength test
- ENGR 300 – Data acquisition and analyzing the experiment data
- ENGR 302 – Beam bending measurement, Pump performance, Pipe friction

In ENGR 430 (Soil Mechanics), students integrate their laboratory results into a semester-long design project. The end result is a professional consulting-style report to an assumed client on the field test of a site. The soil lab includes seven activities as follows:

- Field and lab visual soil identification and classification
- Liquid limit test
- Plastic limit test
- Sieve analysis
- In-situ density test
- Compaction test
- Consolidation test
• Soil permeability test

**Civil Engineering Design including sustainability**

Design in the civil engineering curriculum is first discussed under Criterion 5. This section provides additional information with particular emphasis on the integration of design experiences throughout the professional component of the curriculum. The Civil Engineering curriculum emphasizes professionalism and engineering design throughout the curriculum. Our students are exposed to the design process through open-ended laboratory experiments, design homework problems, design projects, and lectures.

**Open-ended Laboratory Experiments**

The students are assigned open-ended projects in ENGR 300 and ENGR 302. They are directed to investigate a phenomenon, but are given only limited guidance in "how" to accomplish the task. It is left to the students to develop the experimental plan, to select the required instrumentation, to evaluate preliminary results, to modify the experiment as necessary, to conduct the experiment, and to interpret and present the results. These activities provide the student with the general experience of in the design of engineering experiments.

**Design Homework Problems**

Many homework problems are formulated to include design issues: formulation of design problem statements, use of design methodologies, consideration of alternate solutions, and feasibility considerations. While this is the norm in the courses strongly oriented toward design (such as Reinforced Concrete Structures, Steel Structures, and Wood Structures), this practice is also incorporated in courses more oriented toward analysis (such as Structural Analysis). Some problems are "open-ended," requiring the student to make a variety of decisions on the way to the ultimate solution. Making and justifying these decisions is an important element in the design process.

**Design Projects**

The assignment of design projects is the classic way of teaching engineering design. In our program, we assign design projects of increasing complexity as students’ progress through the curriculum, especially in the 400-level courses. Design projects are assigned in ENGR 430 (Soil Mechanics), ENGR 431 (Foundation Engineering), ENGR 425 (Reinforced structures), ENGR 426 (Steel Structures) and ENGR 427 (Timber Structures).
The two-semester senior project (ENGR 696 and 697) is viewed as a capstone experience in which much of the engineering knowledge developed during the four-year curriculum can be focused on a major design project along with the sustainability of the project.

Computer programs are commonly used in design projects to aid in the iterative nature of design. Since computer programs are used considerably in engineering practice, this exposes students to real-world procedures. Emphasis is also placed on using engineering judgment and hand calculations to check the reliability of the computer solutions.

**Lectures**

All members of the civil engineering faculty have strong backgrounds in engineering design and consulting. The faculty is able to illustrate design concepts and procedures thanks to their own experience, and able to clarify the ties between science and art in design. Economic factors, safety, and social impact are often discussed as constraints on the design process.

**Engineering Design Units**

Although ABET no longer requires a minimum amount of engineering design units, we believe that one-half year (17 units) of engineering design is still an appropriate goal. The civil engineering curriculum provides an estimated 13.5 units of design content through the required courses. Since several of these units may not be considered strictly “civil engineering” content, we require our students to take civil engineering electives which contribute a minimum of 3.5 additional units in engineering design. Thus, a graduating student has at least 17 units of engineering design.

**Management, business, public policy, leadership, ethics and professional licensure**

The civil engineering curriculum provides students with an understanding of professional practice issues primarily through Construction Management (ENGR 429) and Engineering Design Project I (ENGR 696).

Because civil engineers deal with projects that have a serious impact on the safety and well-being of the public, they are held to high standards in the performance of their professional duties. Civil Engineering students need to have a basic understanding of the regulatory environment of engineering, the ethical obligations of engineers, and the boundaries of the “standards of care” expected of engineers. At San Francisco State University, civil engineering students are exposed to the rules and the institutions regulating the practice of civil engineering in California, including licensing, oversight, and dealing with engineers suspected of violating the code of professional practice. All civil engineering students are strongly encouraged to plan on obtaining their professional license at their earliest opportunity, and all students are expected
to take the FE exam while they are in school. Professional ethics is emphasized in at least two courses (ENGR 429 and ENGR 696) where the codes of ethics of the American Society of Civil Engineers (ASCE) and the National Society of Professional Engineers (NSPE) are discussed and debated. Actual case studies published in the California Board of Registration for Professional Engineers and Land Surveyors Bulletin (Board News and Enforcement Actions) are presented and discussed in class.

**Faculty teaching design courses**

The Civil Engineering faculty consists of five tenured/tenure-track faculty with primary expertise in the areas indicated below:

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Area of Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheng Chen</td>
<td>Structural Engineering</td>
</tr>
<tr>
<td>Timothy D’Orazio</td>
<td>Geotechnical Engineering</td>
</tr>
<tr>
<td>Elahe Enssani</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>Zhaoshuo Jiang</td>
<td>Structural Engineering</td>
</tr>
<tr>
<td>Wenshen Pong</td>
<td>Structural Engineering</td>
</tr>
<tr>
<td>Ghassan Tarakji</td>
<td>Construction Management</td>
</tr>
<tr>
<td>Jenna Wong</td>
<td>Structural Engineering</td>
</tr>
</tbody>
</table>

Six of the seven faculty are registered Professional Engineers (Civil) in California, have consulting and/or industrial experience, and have earned doctoral degrees. The one non-licensed faculty member, Dr. Cheng Chen, is in the process of obtaining a professional engineering license in California. Curriculum vitae for all faculty members are located in Appendix B. We believe that this faculty is qualified to teach design courses.

Faculty in mechanical and electrical engineering teach some of the courses in the civil engineering curriculum. Resumes for these faculty can be found in the Self-Study Reports for those programs.

**Not dependent on one individual**

Civil engineering faculty have different areas of expertise, and the courses that we offer cover these different areas. No one faculty member has the qualifications to teach all the classes, nor do we ask a faculty member to teach outside his or her specialty. Therefore, we believe that our program is clearly not dependent on a single individual.
APPENDIX A

COURSE SYLLABI
1. Course number and name
   ENGR 100: Introduction to Engineering

2. Credits and contact hours
   1 credit hour; one hour lecture session/week.

3. Instructor's or course coordinator's name
   Instructor: Robert Paul Levenson
   Course coordinator: Jonathan Song Lecturer and Computer Lab Manager

4. Text book, title, author, and year
   a. other supplemental materials

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Description of the major engineering fields and their subfields. Day to day activities of engineers. Engineering professionalism, ethics, lifelong learning, and career planning. Survival skills. Safety issues and School of Engineering policies
   b. prerequisites or co-requisites
      High school algebra and trigonometry.
   c. indicate whether a required, elective, or selected elective course (as per Table 5-1) in the program
      Required for Civil, Electrical, Mechanical and Computer Engineering.

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
• Students understand the benefits and consequences of engineering solutions to societal and global problems.

• To develop written and oral communication skills.

b. *explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*
   
   Course addresses ABET Student Outcome(s): f, g, h, i, j

7. **Brief list of topics to be covered**
   • Introduction to Civil, Mechanical and Electrical Engineering
   • Engineering Professionalism and Success
   • Description of Major Engineering Fields
   • Engineering Ethics, Global and Societal Issues
   • Engineering Societies
   • Writing Communication Skills
   • Oral Communication Skills
1. Course number and name
   ENGR 101: Engineering Graphics Lab

2. Credits and contact hours
   1 credit hour; one 2-hour-45-minute lab session/week

3. Instructor’s or course coordinator’s name
   Instructor: Amir Tabrizi, Lecturer
   Course coordinator: Zhaoshuo Jiang, Professor of Civil Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      (Optional References).

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Engineering drawing as means of communication. Principals of engineering graphics. Free hand sketching, and introduction to AutoCAD and AutoCAD commands. Engineering drawing with AutoCAD; orthographic projection; lines and dimensioning; reading blueprints; normal, inclined and cylindrical surfaces; sectional views
   b. prerequisites or co-requisites
      ENGR 100: Introduction to Engineering (may be taken concurrently)
   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering and Mechanical Engineering

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      • Students will have a basic knowledge of orthographic projections and sectional views.
      • Students will have a basic knowledge of isometric projection.
      • Students will use AutoCAD software to generate drawings.
      • Students will learn drafting geometry, dimensions, engineering graphics, tolerances, and the interpretation of blueprints.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): k.

7. Brief list of topics to be covered
- Principles of Engineering Graphics
- Free–hand lettering
- Free–hand sketching
- Orthographic projection
- Normal surfaces
- Inclined surfaces
- Cylindrical surfaces
- Sectional views
- Lines and dimensions
- Tolerances
- CAD drawings
- Drafting geometry with CAD software
- Isometric drawings using CAD software
- Interpreting blueprints
1. Course number and name
   ENGR 102  Statics

2. Credits and contact hours
   3 Credit Hours

3. Instructor’s or course coordinator’s name
   Instructor:  Timothy B. D’Orazio, Professor of Civil Engineering
   Course coordinator: Timothy B. D’Orazio, Professor of Civil Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      None

( Optional References).

5. Specific course information
   a. brief description of the content of the course (catalog description)

   b. prerequisites or co-requisites
      Math 227, Phys 220

   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil and Mechanical Engineering.

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

      Students will demonstrate an ability to:
      • use vectors to represent forces.
      • sum forces.
      • sum moments.
      • develop force equilibrium equations.
      • develop moment equilibrium equations.
      • evaluate particle equilibrium.
      • analyze equilibrium of frictionless pulley and cable systems.
      • analyze equilibrium of truss systems.
      • analyze equilibrium of machine systems.
      • analyze equilibrium of beam systems.

      Students will demonstrate an ability to:
• determine centroids of areas of various shapes using both integration and summation.
• determine moments of inertia about axes using both integration and summation.

Students will demonstrate an ability to:
• analyze the behavior of blocks on ramps with friction.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, e

7. Brief list of topics to be covered

• Using vectors to represent forces.
• Summing forces.
• Summing moments.
• Developing force equilibrium equations.
• Developing moment equilibrium equations.
• Particle equilibrium.
• Equilibrium of frictionless pulley and cable systems.
• Analyzing equilibrium of truss systems.
• Analyzing equilibrium of machine systems.
• Analyzing equilibrium of beam systems.
• Determining centroids of areas.
• Determining moments of inertia.
• Analyzing equilibrium of systems with friction.
1. Course number and name
   ENGR 103: Introduction to Computers

2. Credits and contact hours
   1 credit hour; one 2-hour-45-minute lab session/week

3. Instructor’s or course coordinator’s name
   Instructor: Susan M. Bowley, Ph.D.
   Course coordinator: Cheng Chen, Associate Professor

4. Text book, title, author, and year

   a. other supplemental materials
      • Arduino Starter Kit

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Introductory course on programming, using a high-level language. Use of algorithms. Program organization, formulation, and solution of engineering problems. Laboratory.
   b. prerequisites or co-requisites
      MATH 226: Calculus I
   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering and Mechanical Engineering

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      • Students will demonstrate an ability to use PC based computers and the university main frame.
      • Students will demonstrate an ability to use the ANSI-C compiler with multiple operating systems by using PCs and the main frame.
      • Students will demonstrate knowledge of the basic grammar of ANSI-C language.
      • Students will demonstrate knowledge of "hands–on" practice in the engineering computer lab.
      • The student will demonstrate knowledge of writing basic engineering problems.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): A, K

7. Brief list of topics to be covered
   - Introduction to Computers, the Internet and the Web
   - Introduction to C Programming
   - Structured Program Development in C
   - C Program Control
   - C Functions
   - C Arrays
   - C Pointers
   - C Characters and Strings
   - C Formatted Input/Output
   - C Structures, Unions, Bit Manipulation and Enumerations
   - C File Processing
   - C Data Structures
   - C Preprocessor
   - Other C Topics
   - C++ as a Better C; Introducing Object Technology
1. Course number and name
   ENGR 200: Materials of Engineering

2. Credits and contact hours
   3 credit hours: two 50-minute lecture sessions/week and one 2-hour-45-minute laboratory session/week

3. Instructor’s or course coordinator’s name
   Instructor: Kwok Siong Teh, Associate Professor of Mechanical Engineering
   Course coordinator: Kwok Siong Teh, Associate Professor of Mechanical Engineering

4. Text book, title, author, and year

   b. other supplemental materials
      (none)

5. Specific course information
   d. brief description of the content of the course (catalog description)
      Application of basic principles of physics and chemistry to engineering materials; their structure and properties and the means by which these materials can be made of better service to all fields of engineering.

   e. prerequisites or co-requisites
      CHEM 115: General Chemistry I, or CHEM 180: Chemistry for the Energy and the Environment

   f. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering; required for Mechanical Engineering

6. Specific goals for the course
   c. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      - The student will demonstrate an ability to describe and solve problems on atomic arrangements, geometry of imperfections, and atomic diffusion in solids.
      - The student will demonstrate an ability to describe and solve problems on mechanical and electrical behavior of materials.
      - The student will demonstrate an ability to submit homework solutions in proper engineering format.
      - The student will demonstrate an ability to describe and solve problems on the distinguishing properties of metals, plastics and ceramics.
- The student will demonstrate a familiarity with the effects of thermal, mechanical, and chemical treatments on properties.
- The student will demonstrate an ability to experimentally determine mechanical and electrical properties of materials.
- The student will demonstrate an ability to make oral presentations and write a technical report.

d. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
   Course addresses ABET Student Outcome(s): a, b, c, d, e, g, h, i, j, k.

7. Brief list of topics to be covered
   - Atomic structure and bonding
   - Crystal structures and geometry
   - Mechanical properties of metals
   - Crystal imperfections
   - Strengthening mechanisms
   - Heat treatment
   - Solidification
   - Diffusion
   - Fracture mechanics
   - Fatigue failure
   - Creep
   - Phase diagrams
   - Phase transformation
   - Engineering alloys
   - Thermal processing of metals
   - Polymers
   - Composite materials
   - Concrete mixing and testing
   - Electrical properties of materials
   - Semiconductors
   - Contemporary topics in materials science
1. **Course number and name**  
ENGR 201: Dynamics

2. **Credits and contact hours**  
3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**  
Instructor: Kwok Siong Teh, Associate Professor of Mechanical Engineering  
Course coordinator: Kwok Siong Teh, Associate Professor of Mechanical Engineering

4. **Text book, title, author, and year**  

c. **Other supplemental materials**  

5. **Specific course information**  
g. **Brief description of the content of the course (catalog description)**  
Vector treatment of kinematics and kinetics of particles, systems of particles and rigid bodies.  
Methods of work, energy, impulse and momentum. Vibrations and time response. Applications to one– and two–dimensional engineering problems

h. **Prerequisites or co-requisites**  
ENGR 102: Statics

i. **Indicate whether a required, elective, or selected elective course in the program**  
Required for Civil Engineering; required for Mechanical Engineering

6. **Specific goals for the course**  
e. **Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
- Students will demonstrate a good understanding of the motion, velocity and acceleration of a point.  
- Students will demonstrate a good understanding of the difference between a curve and its parameterization.  
- Students will demonstrate a good understanding of the use of the instantaneous state to derive equations of motion.  
- Students will demonstrate a good understanding of the meaning of the terms in Newton’s Laws of Motion, especially the second law $F=ma$.  
- Students will demonstrate a good understanding of the concepts of work, energy, and power.  
- Students will demonstrate a good understanding of conservative and non-conservative system.  
- Students will demonstrate a good understanding of the concept of angular velocity of a rigid body or reference frame.
• Students will demonstrate a good understanding of time rates of change of unit vectors in a rotating reference frame.
• Students will demonstrate a good understanding of absolute and relative velocity and acceleration in a rotating reference frame.
• Students will demonstrate a good understanding of the computation of linear momentum and moment of a rigid body.
• Students will demonstrate a good understanding of the use of Euler’s laws of motion for two-dimensional problems.
• Students will demonstrate a good understanding of the concept of frequency and period for simple harmonic motion.
• Students will demonstrate a good understanding of the governing equation for the simple harmonic oscillator.

f. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, e, g, h, i, j, k.

7. Brief list of topics to be covered
• Position vector and its derivatives – velocity and acceleration.
• Rectilinear motion.
• Curvilinear motion in Cartesian, normal-tangential, and cylindrical coordinate systems.
• Constrained motion.
• Newton’s laws of motion, especially the second law \( F = ma \).
• Work, energy, and conservation of energy.
• Power.
• Linear impulse and momentum.
• Angular impulse and momentum.
• Conservation of linear and angular momentums.
• Impact and collisions.
• Two-dimensional rigid body kinematics.
• Euler’s laws of motion for rigid bodies.
• Energy methods in rigid body motion.
• Free vibration (with and without damping)
• Forced vibration (with and without damping)
1. **Course number and name**  
   **Engr 205 Electric Circuits**

2. **Credits and contact hours**  
   3 Credits

3. **Instructor’s or course coordinator’s name**  
   Instructor: John Kim, Ph.D  
   Course coordinator: Hao Jiang, Associate Prof. in EE

4. **Text book, title, author, and year**  

5. **Specific course information**  
   a. **brief description of the content of the course (catalog description)**
      Circuit analysis, modeling, equivalence, circuit theorems. Ideal transformers and operational amplifiers. Transient response of 1st-order circuits. AC response, phasor analysis, AC impedance, AC power.

   b. **prerequisites or co-requisites**  
      PHYS 230 and MATH 245; MATH 245 may be taken concurrently.

   c. **indicate whether a required, elective, or selected elective course in the program**  
      Required for Civil, Electrical, Mechanical and Computer Engineering.

6. **Specific goals for the course**  
   c. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      - The student will demonstrate an ability to formulate circuit equations and solve for multiple unknowns.
      - The student will demonstrate an ability to perform transient analyses of 1st-order circuits.
      - The student will demonstrate an ability to extend resistive-circuit analysis techniques to AC circuits using phasor algebra.
      - The student will demonstrate an understanding of the $i-v$ characteristics of sources and basic $R$, $L$, and $C$ elements, their idealized models, and the practical limitations of such models.
• The student will demonstrate knowledge of how to apply ideal transformer and op amp models to the analysis of basic circuit configurations.
• The student will demonstrate knowledge of how to apply circuit reduction techniques to simplify circuits or portions thereof.
• The student will demonstrate an understanding of terminology, concepts, and methodology common to engineering.
• The student will demonstrate an ability to apply a structured methodology to solve analytical as well as design-oriented problems.
• The student will demonstrate an ability to recognize inadmissible circuit configurations and unrealistic results.

d. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): [a,c].

7. Brief list of topics to be covered
• Electricity, signals, and circuits
• Circuit analysis techniques
• Network theorems and circuit modeling
• Dependent sources, ideal transformers, amplifiers
• Op amps and basic instrumentation applications
• Energy-storage elements
• Natural, forced, transient, and steady-state responses
• Phasor algebra, impedance, and AC circuit analysis
• Power calculations
1. Course number and name
ENGR 235: Surveying

2. Credits and contact hours
3 credit hours; two 50-minute lecture sessions and one 150-minute laboratory session/week

3. Instructor’s or course coordinator’s name
Instructor: Ghassan Tarakji, Professor of Civil Engineering
Course coordinator: Ghassan Tarakji, Professor of Civil Engineering

4. Text book, title, author, and year

d. other supplemental materials

5. Specific course information
a) brief description of the content of the course (catalog description)
Surveying: distance, elevation, and direction measurements; traverse analysis; contours; topography; areas calculations. Introduction to GPS and GIS. The US public lands system.

b) prerequisites or co-requisites
ENGR 100: Introduction to Engineering
MATH 226: Calculus I (Graphs. Differentiation: theory, techniques, and applications. Integration: Fundamental Theorem of Calculus and applications. Transcendental functions)

c) indicate whether a required, elective, or selected elective course in the program
Required for Civil Engineering

6. Specific goals for the course
e. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
   • Students will demonstrate an understanding of the tools and applications of surveying in civil engineering and construction.
   • Students will demonstrate an understanding of gross, systematic, and random errors.
   • Students will demonstrate that they are able to perform distance measurements and to perform the necessary corrections to these measurements.
   • Students will demonstrate that they are able to perform elevation measurements and to perform the necessary corrections to these measurements.
   • Students will demonstrate that they are able to perform direction measurements and to perform the necessary corrections to these measurements.
   • Students will demonstrate the ability to calculate the area of a traverse.
   • Students will demonstrate that they can perform traverse analysis and corrections.
   • Students will demonstrate an understanding of the concepts of GPS and GIS, and the applications of these two systems in the practice of surveying.
   • Students will demonstrate an understanding of the US Public Lands System.
• Students will demonstrate their ability to complete a project that includes both surveying data collection and computations.

f. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): [list outcomes by letter].

N/A

7. Brief list of topics to be covered (Tentative)

• Introduction and background
• Distance measurement and correction
• Differential and profile leveling
• Angles and directions
• Traverse analysis
• Contours and topography
• Area calculations
• Introduction to GPS
• Introduction to GIS
• U.S. public lands system
• Project

Brief list of laboratory experiments to be covered (Tentative)

• Swift Measurements (pacing and rolling wheel) and referencing points
• Stadia distance measurement
• Precise taping
• Leveling along a loop
• Profile leveling
• Closing the horizon using the theodolite
• Measurement of interior angles using the theodolite
• Traverse measurements using total station
• Staking out points using total station
• Traverse analysis
1. **Course number and name**
   
   ENGR 300: Engineering Experimentation

2. **Credits and contact hours**
   
   3 units. Two 1-hr lectures and one 2-hr, 45-min lab session per week.

3. **Instructor’s or course coordinator’s name**
   
   Instructor: Mutlu Ozer, Instructor (lecture); Mutlu Ozer, Instructor and Dipendra Sinha, Professor (lab)
   
   Course coordinator: Ed Cheng, Associate Professor

4. **Text book, title, author, and year**
   
   
   **e. other supplemental materials**
   
   ENGR 300 Laboratory Manual.

5. **Specific course information**
   
   **j. brief description of the content of the course (catalog description)**
   
   
   **k. prerequisites or co-requisites**
   
   ENGR 201 or 206, ENGR 205, ENG 214 with grade of C- or better.

   **l. indicate whether a required, elective, or selected elective course in the program**
   
   Required for Civil Engineering; required for Electrical Engineering; required for Mechanical Engineering.

6. **Specific goals for the course**
   
   **g. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
   
   - Ability to plan an experiment, identifying the primary variables of interest.
   - Ability to make sound engineering assumptions.
   - Ability to select appropriate instrumentation for measurements.
   - Acquisition of “hands-on” skills in using instrumentation.
   - Understanding of good laboratory practices.
   - Ability to work on teams.
   - Ability to set up and troubleshoot experiments.
• Knowledge of data acquisition systems and components.
• Ability to understand and specify/select data acquisition components.
• Ability to specify signal conditioning specifications.
• Knowledge of instrumentation characteristics.
• Knowledge of theory and operation of devices for measuring solid-mechanical quantities.
• Knowledge of theory and operation of devices for measuring pressure, temperature, and humidity.
• Knowledge of theory and operation of devices for measuring fluid flow rate, fluid velocity, and fluid level.
• Ability to compute descriptive statistics for experimental data.
• Ability to understand probability concepts and read statistical distribution tables. Ability to quantify the uncertainty of experimental data.
• Ability to carry out linear regression and understand measurements of correlation for paired data sets.
• Ability to write simple technical memo/letter.
• Ability to write a formal engineering report.
• Ability to make an oral presentation using visual aids.

h. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, b, c, d, e, g, k.

7. Brief list of topics to be covered
• Introduction and General Characteristics of Measurement Systems
• Measurement Systems with Electric Signals
• Computerized Data-Acquisition Systems
• Discrete Sampling and Analysis of Time-Varying Signals
• Statistical Analysis of Experimental Data
• Experimental Uncertainty Analysis
• Measurement of Solid-Mechanical Quantities
• Measuring Pressure, Temperature, and Humidity
• Measuring Fluid Flow Rate, Fluid Velocity, Fluid Level and Combustion Pollutants
• Dynamic Behavior of Measurement Systems
• Guidelines for Planning and Documenting Experiments
1. **Course number and name**  
ENGR 302: Experimental Analysis

2. **Credits and contact hours**  
1 unit. One 2-hr, 45-min lab session per week.

3. **Instructor’s or course coordinator’s name**  
Instructors: Mutlu Ozer, Jonathan Tai  
Course coordinator: Ed Cheng, Associate Professor

4. **Text book, title, author, and year**  
(no textbook required)
   
   f. **other supplemental materials**  
   ENGR 302 Laboratory Manual

5. **Specific course information**  
   m. **brief description of the content of the course (catalog description)**  
   Experimental investigation and analysis of engineering systems: structural elements, fluid devices, and thermal systems. Use of computers for data acquisition.
   
   n. **prerequisites or co-requisites**  
   ENGR 300, 309; ENGR 304 (may be taken concurrently)

   o. **indicate whether a required, elective, or selected elective course in the program**  
   Required for Civil Engineering; required for Mechanical Engineering.

6. **Specific goals for the course**  
i. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
   - Students will be able to use a computer data acquisition system to collect and analyze experimental data.
   - Students will become familiar with common measurement devices including strain gages.
   - Students will be able to plan and design an engineering experiment.
   - Students will be able to apply the basic theory of beam flexure (strains, stresses and deflections) to an experimental system.
   - Students will be able to apply the basic theories of fluid statics and dynamics (manometer equations, Bernoulli equation) to applicable experiments.
   - Students will be able to perform uncertainty analysis for an experimental system.
• Students will be able to write a competent formal report for an engineering experiment.
• Students will be able to write a competent technical memorandum about an engineering experiment.
• Students will be able to give a competent oral presentation.

j. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, b, c, d, e, g, k.

7. Brief list of topics to be covered
• Experimental design
• Computerized data acquisition
• Experimental data analysis, including uncertainty analysis
• Report writing
• Other topics from mechanical and civil engineering depending on experiments performed
1. **Course number and name**
   
   **ENGR 304: Mechanics of Fluids**

2. **Credits and contact hours**
   
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**
   
   Instructor: Paul Tan, Instructor
   
   Course coordinator: Elahe Enssani, Associate Professor of Mechanical Engineering

2. **Text book, title, author, and year**
   

   g. **other supplemental materials**
      
      (none)

3. **Specific course information**
   
   p. **brief description of the content of the course (catalog description)**
      
      Statics and dynamics of incompressible fluids, dimensional analysis, and similitude; fluid friction; laminar and turbulent flow in pipes; forces on submerged structures; fluid measurements.

   q. **prerequisites or co-requisites**
      
      PHYS 240: General Physics with Calculus III (Wave motion, optics, and thermodynamics);
      
      ENGR 201: Dynamics.

   r. **indicate whether a required, elective, or selected elective course in the program**
      
      Required for Civil Engineering; required for Mechanical Engineering.

4. **Specific goals for the course**
   
   k. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      
      - Students will demonstrate that they understand the definition of a fluid and are familiar with properties that describe fluids.
      - Students will demonstrate that they can evaluate pressure variation in a hydrostatic fluid.
      - Students will demonstrate that they can evaluate hydrostatic forces on plane and curved surfaces.
      - Students will demonstrate that they can evaluate buoyancy forces on immersed and floating bodies.
      - Students will demonstrate that they can apply the continuity and Bernoulli equations to fluid systems.
      - Students will demonstrate that they can apply the momentum equation to fluid systems.
• Students will demonstrate that they can apply the energy equation to fluid systems. Students will demonstrate that they can interpret hydraulic and energy grade lines.
• Students will demonstrate that they can identify dimensionless parameters using the Buckingham Pi theorem and dimensional analysis.
• Students will demonstrate that they can use the methods of similitude to specify the requirements for scale model tests.
• Students will demonstrate that they can analyze problems involving boundary layer theory and surface resistance.
• Students will demonstrate that they can analyze problems of laminar and turbulent flow in conduits.
• Students will demonstrate that they can analyze piping systems considering pipe friction and loss coefficients.
• Students will demonstrate that they understand the concepts of drag and lift, and are able to use drag and lift coefficients.
• Students will demonstrate that they can apply selected principles to the design of engineering systems.
• Students will demonstrate that they are familiar with common spreadsheet programs.
• Students will demonstrate that they can write a coherent technical report describing their analysis of and solution to an engineering design problem.

1. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
   Course addresses ABET Student Outcome(s): a, b, c, d, e, g, h, j, k.

5. Brief list of topics to be covered
   • Introduction to fluids and fluid properties
   • Hydrostatic pressure variation
   • Pressure measurements
   • Hydrostatic forces on plane and curved surfaces
   • Buoyancy and stability of immersed and floating bodies
   • Flow visualization
   • Fluid velocity, Lagrangian and Eulerian viewpoints
   • Basic control volume analysis
   • Continuity equation (conservation of mass)
   • Rotation and vorticity
   • Pressure variation in a flowing fluid
   • Bernoulli equation
   • Momentum equation
   • Energy equation
   • Hydraulic and energy grade lines
   • Dimensional analysis and similitude
   • Boundary layer theory and surface resistance
   • Flow in pipes and conduits
   • Drag and lift
1. Course number and name
ENGR 309  Mechanics of Materials

2. Credits and contact hours
3 Credit Hours

3. Instructor’s or course coordinator’s name
Instructor:  Timothy B. D’Orazio & Zhaoshuo Jiang, Professor of Civil Engineering

            Course coordinator:  Zhaoshuo Jiang, Professor of Civil Engineering

4. Text book, title, author, and year

        a. other supplemental materials

5. Specific course information
a. brief description of the content of the course (catalog description)
   Stress and deformation analysis for members under axial load, torsion, flexure, and combined forces: columns, strain energy. Elastic and ultimate resistance of materials.

b. prerequisites or co-requisites
   Engr 102, Engr 200 concurrently.

c. indicate whether a required, elective, or selected elective course in the program
   Required for Civil and Mechanical Engineering.

6. Specific goals for the course
a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
   Students will demonstrate an ability to:

       • Understand basic mechanical properties of solid materials.
       • Stress-strain of brittle and ductile materials.

   Students will demonstrate an ability to:
• Determine internal forces in common civil and mechanical engineering components.  
  Obtain stresses in prismatic bars under axial load.  
• Obtain stresses in circular shafts due to torsion.  
• Obtain stresses in prismatic beams due to bending loads.

Students will demonstrate an ability to:

• Transform stresses from one set of axes to another.  
• Use Mohr’s circle to transform stresses.

Students will demonstrate an ability to:

• Compute deformation of beams under bending.  
• Compute deformation of torsional members. 
• Compute deformation of columns under axial load.

Students will demonstrate an ability to:

• Compute the buckling resistance of axially loaded columns.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course. 
Course addresses ABET Student Outcome(s): a, c, e, i.

7. Brief list of topics to be covered

• Basic concepts of stress and strain  
• Stresses in bodies subject to axial, torsional, and pressure loads.  
• Forces and stresses in beams.  
• Beam deflection.  
• Transformation of stress and strain.  
• Elastic design.  
• Introduction to column stability.
1. Course number and name
   ENGR 323: Structural Analysis

2. Credits and contact hours
   3 credit hours; two 1-hr-15-minute lecture sessions/week

3. Instructor’s or course coordinator’s name
   Instructor: Cheng Chen, Associate Professor of Civil Engineering
   Course coordinator: Cheng Chen, Associate Professor of Civil Engineering

4. Text book, title, author, and year
   Or
   Hibbeler, R.C., Structural Analysis, SFSU Edition, Person Prentice Hall, NJ
   ISBN: 1323572287; 9781323572283
   a. other supplemental materials
      (none)

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Structural engineering, including standards and codes. Determination of loads, discussion of load path. Analysis of statically determinate structures. Forces within statically indeterminate structures. Structural analysis software.

   b. prerequisites or co-requisites

   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering.

6. Specific goals for the course
   • specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
   • Student is aware of the major phases of the structural engineering project.
   • Student is aware of ASCE Standard 7 and the UBC/IBC.
   • Student can obtain loads on structures using ASCE Standard 7.
   • Student can determine the load path through common structures.
   • Student recognizes when a structure is unstable and how to make it stable.
   • Student recognizes when a structure is indeterminate and the number of degrees.
- Student is able to compute internal forces in beams and readily construct shear and moment diagrams.
- Student is able to compute bar forces in trusses.
- Student can use classical methods for computing deflections, such as, moment-area method and virtual work.
- Student can apply the method of consistent deformations for solving statically indeterminate trusses, beam and frames.
- Student can apply the method of moment distribution to solve statically indeterminate beams and frames.
- Student can make qualitatively correct sketches of deflections and moment diagrams for statically determinate beams and frames.
- Student can make qualitatively correct sketches of deflections and moment.
- Student is able to use a computer program (selected by instructor) to model and to solve problems similar to problems done “by hand.”
- Students are able to work effectively in teams.

a. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
   Course addresses ABET Student Outcome(s): c, d, e, f, i, k,

7. Brief list of topics to be covered
- Introduction to structures and loads.
- Static determinacy and indeterminacy.
- Stable and unstable planar structures.
- Reactions for planar structures.
- Forces in statically determinate trusses.
- Forces in statically determinate beams and frames.
- Deflections in statically determinate trusses.
- Deflections in statically determinate beams and frames.
- Forces in statically indeterminate trusses.
- Forces in statically indeterminate beams and frames.
- Deflections in statically indeterminate trusses.
- Deflections in statically indeterminate beams and frames.
- Forces and deflections using computer software SAP2000.
1. **Course number and name**
   ENGR 425: Reinforced Concrete Structures

2. **Credits and contact hours**
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**
   Instructor: Zhaoshuo Jiang, Professor of Civil Engineering
   Course coordinator: Zhaoshuo Jiang, Professor of Civil Engineering

4. **Text book, title, author, and year**

   a. **other supplemental materials**


   PCA Notes on ACI 318-08 Building Code Requirements for Structural Concrete, Portland Cement Association, Skokie, IL, 2008.

5. **Specific course information**
   a. **brief description of the content of the course (catalog description)**

   b. **prerequisites or co-requisites**
   ENGR 323: Structural Analysis

   c. **indicate whether a required, elective, or selected elective course in the program**
   Elective for Civil Engineering
6. **Specific goals for the course**
   
   a. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**

   - The student will demonstrate a knowledge of mechanics of reinforced concrete.
   - The student will demonstrate a knowledge of reinforced concrete behavior when subjected to bending, axial load and torsion.
   - The student will demonstrate a knowledge of whether optimum design has been achieved.
   - The student will demonstrate a knowledge of design procedures for reinforced concrete structures.
   - The student will demonstrate a knowledge of the design method: Ultimate Design Method. The student will demonstrate knowledge of the design of columns.
   - The student will demonstrate knowledge of the design of beams.
   - The student will demonstrate a knowledge of the design of reinforced concrete slabs.
   - The student will demonstrate a knowledge of the design of footings.
   - The student will demonstrate skill in solving practical engineering problems through project assignments.
   - The student will demonstrate an understanding of the design building codes and the background of codes.
   - The student will demonstrate skill in applying codes and specifications to design reinforced concrete structural members.

   b. **explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**
   
   Course addresses ABET Student Outcome(s): a, c, e, i, k.

7. **Brief list of topics to be covered**

   - Footings
   - Structural Design Process and Principles.
   - Structural Load Paths
   - Reinforced Concrete Behaviors and Properties.
   - Flexure: Beams
   - Flexure: T Beams
   - Shear in Beams
   - Development, Anchorage, and Splicing of Reinforcement
   - Serviceability
   - Continuous Beams
   - One-way Slabs
   - Columns: Combined Axial Load and Bending
   - Slender Columns
   - Footings
   - Professional Software: S-Frame Suite
1. **Course number and name**  
   ENGR 429: Construction Management

2. **Credits and contact hours**  
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor's or course coordinator’s name**  
   Instructor: G. Tarakji, Professor of Civil Engineering  
   Course coordinator: Ghassan Tarakji, Professor of Civil Engineering

4. **Text book, title, author, and year**  

   **h. other supplemental materials**  
   None

5. **Specific course information**  
   **s. brief description of the content of the course (catalog description)**  
   Construction engineering and management; professional practice and ethics; bidding and contracting; planning and scheduling, network diagrams, scheduling computations, resource management, computer applications; cost estimating; construction safety.

   **t. prerequisites or co-requisites**  
   ENGR 235: Surveying

6. **Specific goals for the course**  
   **m. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
   - The students will demonstrate an understanding of the characteristics of the construction industry and the challenges facing it.  
   - The students will demonstrate familiarity with the environment of engineering professionalism, including licensing requirements and professional regulations.  
   - The students will demonstrate an understanding of the contractual relationships in construction.  
   - The students will demonstrate familiarity with pertinent code(s) of ethics and an understanding of, and an appreciation for the ethical obligations of engineers.  
   - The students will demonstrate an understanding of network diagrams as used in CPM and PERT.
• The students will demonstrate the ability to perform scheduling computations, including activity start and finish times, floats, and determining the effect of activity crashing on project duration and cost.
• The students will demonstrate an understanding of scheduling software commonly used in the construction industry (e.g. PRIMAVERA), and the ability to use it in simple scheduling problems.
• The students will demonstrate the ability to perform quantity take-off, obtain unit prices, and estimate project costs.
• The students will demonstrate an understanding of the safety issues in construction projects and familiarity with construction safety programs.

n. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s):

B3: Engr. Tools, software, instrumentation
C3: Professional ethics

7. Brief list of topics to be covered
  • Overview of the construction industry
  • Contractual relationships in construction
  • Bidding and contracting
  • Professional practice and ethics
  • Network diagrams (Arrow and Precedence)
  • Project planning and scheduling
  • Crashing
  • Time-scale networks
  • Resource management
  • Introduction to PERT
  • Computer applications in project scheduling
  • Estimating
  • Construction safety
1. Course number and name
   ENGR 430 Soil Mechanics

2. Credits and contact hours
   3 Credit Hours

3. Instructor’s or course coordinator’s name
   Instructor: T.B. D’Orazio, Professor of Civil Engineering
   Course coordinator: T.B. D’Orazio, Professor of Civil Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      None.

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Soil as an engineering material with emphasis on identification, physical and mechanical properties.
      Evaluation of water flow through soil, settlement, soil strength, earth pressures, pile pullout capacity,
      and basic slope stability. Laboratory based term project.
   b. prerequisites or co-requisites
      ENGR. 309
   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering.

6. Specific goals for the course. Specific outcomes of instruction.
   • The student will demonstrate an ability to visually identify and classify soils.
   • The student will demonstrate an ability to classify soils based on the results of laboratory tests.
   • The student will demonstrate an ability to perform fundamental soil laboratory tests.
   • The student will demonstrate an ability to evaluate and present the results of fundamental soil
     laboratory tests.
   • The student will demonstrate an ability to describe basic soil compaction specifications in terms of
     maximum dry density and optimum water content based on the results of laboratory compaction tests.
   • The student will demonstrate an ability to recognize and describe potential problems at a particular
     site given a soil profile and other environmental type information.
   • The student will demonstrate an ability to propose and develop solutions to geotechnical problems
     and understand their impact on the surroundings.
   • The student will demonstrate an ability to calculate in situ total and effective stress from standard soil
     profile information.
   • The student will demonstrate an ability to evaluate consolidation properties from the results of
     consolidation tests.
   • The student will demonstrate an ability to evaluate settlement given load and soil property
     information.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, b, c, e, f, g, h, k.

7. Brief list of topics to be covered

- Clay mineralogy
- Clay structure, sand structure, soil formation
- Soils used for construction materials
- Flow through soils, flow nets, permeability testing
- Stresses in soil with depth in a soil deposit
- Effective stresses under conditions of flow
- Consolidation of clay
1. **Course number and name**  
ENGR 434 Principles of Environmental Engineering

2. **Credits and contact hours**  
3 units. Two 75-minutes or three 50-minutes lecture per week.

3. **Instructor’s or course coordinator’s name**  
Instructors: Elahe Enssani, Ph.D., P.E.  
Course coordinator: Elahe Enssani, Ph.D., P.E., and Associate Professor of Civil Engineering

4. **Text book, title, author, and year**  
Viessman, Jr., Warren and Mark J. Hammer. Water Supply and Pollution Control, 8th edition,  
Addison Wesley, 2008.

   a. **other supplemental materials**  
   Class Reader (and all course material including HW) on SFSU ILearn.  
   Masters, Gilbert M., Introduction to Environmental Engineering and Science, 3rd edition, Prentice  

5. **Specific course information**  
   a. **brief description of the content of the course (catalog description)**  
   Principles and fundamentals of environmental engineering. Topics include water resources,  
   ground hydrology, water quality, water chemistry, water and wastewater treatment, air quality,  
   and solid waste management.

   b. **prerequisites or co-requisites**  
   ENGR 304 (Fluid Mechanics, may be taken concurrently)  
   CHEM 115 or 180 (Chemistry)

   c. **indicate whether a required, elective, or selected elective course in the program**  
   Required for Civil Engineering.
6. **Specific goals for the course**
   a. **Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      - Develop student understanding of the basic concepts in water resources.
      - Develop student understanding of the fundamental principles of water chemistry as needed in environmental engineering.
      - Develop student understanding of the fundamentals of water quality parameters and criteria.
      - Develop student understanding of the fundamentals of water treatment processes.
      - Acquaint student with fundamentals of wastewater collection systems design.

   b. **Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**
      Course addresses ABET Student Outcome(s): a, b, c, e, i.

7. **Brief list of topics to be covered**
   - Hydrologic Cycle.
   - Municipal Water consumption and water resources.
   - Ground water hydrology.
   - Water law doctrines.
   - Reservoir Design, Transmission Facilities, distribution systems.
   - Water quality parameters.
   - Water chemistry.
   - Drinking water standards.
   - Disinfection.
   - Water treatment processes.
   - Wastewater collection, sewer systems.
   - Wastewater treatment processes.
   - Solid Waste/Hazardous Waste Management
   - Air Quality Criteria/Management
   - Contemporary issues Global Climate Change/Sustainability/Energy and Environment
1. Course number and name
   ENGR 436: Transportation Engineering

2. Credits and contact hours
   3 credit hours; three 50-minute lecture sessions/week, or two 1hr-15-minute lecture sessions/week, depending on semester.

3. Instructor's or course coordinator's name
   Instructor: Dragomir Bogdanic, Instructor
   Course coordinator: Ghassan Tarakji, Professor of Civil Engineering

4. Text book, title, author, and year
   None
   a. other supplemental materials

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Principles, theories, and practice of transportation planning and design.
   b. prerequisites or co-requisites
      ENGR 235: Surveying
      ENGR 430: Soil Mechanics (may be taken concurrently)
   c. indicate whether a required, elective, or selected elective course in the program
      Required for Civil Engineering

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      • The student must gain an understanding of the five modes of transportation, and the significance of each of these modes in the U.S.
      • The student must gain knowledge in the geometric design of highways (sight distances, horizontal and vertical curves, lane width, shoulders, etc.)
      • The student must demonstrate familiarity with the AASHTO standards for roadway design.
      • The student must learn some of the methods for evaluating traffic demand, highway capacity, and level of service.
      • The student must learn how to perform earthwork calculations.
The student must be able to draw and analyze mass-diagrams, and use this information to determine and analyze the amounts of cut, fill, borrow, waste, and over-haul.

- The student must learn about the tools of pavement design and pavement preservation.
- The student must learn how to draw wind-rose diagrams, and utilize this information to optimize runway orientation.
- The student must learn how to apply and use queuing theory in transportation problems.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): c, g, i

7. Brief list of topics to be covered
- Introduction and background
- The U.S. transportation system
- Roadway, air, rail, pipeline, water, and urban mass transit systems
- Transportation planning
- Traffic analysis techniques
- Capacity and level of service
- Geometric Design of Highways
- Earthwork and mass diagrams
- Design of flexible and rigid pavements
- Pavement preservation
- Airport planning and design
- Wind-Rose analysis
- Queuing theory
1. **Course number and name**  
   ENGR 696: Engineering Design Project I

2. **Credits and contact hours**  
   1 Credit Hour, One 2-hour-45-minute lab session/week.

3. **Instructor’s or course coordinator’s name**  
   Instructor: Timothy D’Orazio and Cheng Chen Professor of Civil Engineering  
   Course coordinator: Timothy D’Orazio, Professor of Civil Engineering

4. **Text book, title, author, and year**  
   None

   a. other supplemental materials  
   None

5. **Specific course information**  
   a. brief description of the content of the course (catalog description)  
   Selection of design project, methods of research, time management, engineering professional practice, and ethics.

   b. prerequisites or co-requisites  
   Completion of at least 21 upper division units in engineering.

   c. indicate whether a required, elective, or selected elective course in the program  
   Required for Civil Engineering.

6. **Specific goals for the course.**

   • Student utilizes a systematic approach to the different stages of the design process.  
   • Student uses library (conventional) and electronic means to access technical and component information related to the design project.  
   • Student is aware of professional engineering societies.  
   • Student forms a team with other students, prepares a preliminary proposal and secures a faculty advisor for the senior project.  
   • Student team develops a thorough project description including a time-task schedule, which is detailed in the final proposal.  
   • Student team describes early project work using oral and written progress reports. Student attends 3 professional seminars and 2 society meetings.  
   • Student fully participates with the team in making decisions, allocating responsibilities and sharing project work.  
   • Student submits all homework in the form of engineering technical memos.  
   • Student prepares and presents effective oral and written presentations describing the project.  
   • Student recognizes importance of punctuality, participation, communication skills and teamwork in the professional setting.

   a. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): c, d, e, f, g, h, i, j, k

7. **Brief list of topics to be covered**

- Design process and methodology
- Scheduling and time management
- Literature, resource, and component information gathering
- Oral and written communication
- Career development
- Ethics
- Professionalism
1. Course number and name
   ENGR 697: Engineering Design Project II

2. Credits and contact hours
   2 Credit Hours, One 2-hour-45-minute lab session/week

3. Instructor’s or course coordinator’s name
   Instructor: Dr. Timothy D'Orazio and Dr. Cheng Chen
   Course coordinator: Timothy D’Orazio, Professor of Civil Engineering

4. Text book, title, author, and year
   None
   a. other supplemental materials
      None.

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Continue work on design project with maximum independence under supervision of a faculty
      adviser. Oral and written project reports required.
   
      b. prerequisites or co-requisites
         ENGR 696
   
      c. indicate whether a required, elective, or selected elective course in the program
         Required for Civil Engineering.

6. Specific goals for the course.

   • Each student, in cooperation with his/her project team, organizes the project into tasks and assumes
     individual responsibility for various tasks.
   • Each student is responsible for pursuing his/her assigned activities in depth, utilizing knowledge
     obtained from prior courses.
   • In concert with team members, each student must contribute a significant body of work to the overall
     project
   • Students will listen to each others opinions and support each others activities. Each student
     coordinates his/her tasks with fellow team members
   • When problems arise on technical or managerial aspects of the project, students discuss the problems
     with fellow team members and seek guidance from the faculty advisor(s).
   • Students identify and provide appropriate discussion of constraints in oral presentations and written
     final report.
   • Each student prepares and clearly presents a portion of the final oral report.
   • Individual student oral presentations are effectively coordinated with the entire team so that the team
     presentation is clear and unified.
   • Each student prepares and clearly presents a portion of the final written report.
   • Individual contributions to the final report are effectively coordinated with other contributions and the
     final written report is clear and unified.
   • Each student assumes responsibility for his/her individual tasks.
   • Each student maintains a cordial working relation with fellow teammates.
   • Each student successfully completes assignments in a punctual manner.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): b, c, d, e, f, g, i, k

7. Brief list of topics to be covered
   • Organization and management of project tasks.
   • Satisfying the clients (faculty advisor and instructor).
   • Bringing a project to successful conclusion.
   • Effective communication of project results in oral and written forms.
1. **Course number and name**
   ENGR 303: Thermodynamics

2. **Credits and contact hours**
   3 Credits; two 75 minutes lectures/sessions per week.

3. **Instructor’s or course coordinator’s name**
   Course Coordinator: Dr. Ahmad R. Ganji
   Course Instructor: Dr. Ahmad Ganji and Dr. Douglas Codron

4. **Text book, title, author, and year**
   a. **other supplemental materials**
      Any other basic course in Thermodynamics, such as: Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, John Wiley & Sons, any edition.

5. **Specific course information**
   a. **brief description of the content of the course (catalog description)**
      Application of thermodynamics to a wide variety of energy exchanging devices; properties of the pure substance, ideal gases and mixtures; power and refrigeration cycles.
   b. **prerequisites or co-requisites**
      PHYSICS 240 - General Physics with Calculus III
   c. **indicate whether a required, elective, or selected elective course in the program**
      The course is required for Mechanical Engineering and can be taken as elective by Civil and Electrical Engineering students.

6. **Specific goals for the course**
   a. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      - The student will demonstrate basic understanding and knowledge of thermodynamic properties of substances;
      - The student will demonstrate basic understanding and knowledge of first law of thermodynamic and its application to open and closed systems;
      - The student will demonstrate basic understanding and knowledge of the second laws of thermodynamic and its application to open and closed systems;
      - The student will demonstrate basic understanding and knowledge of conservation of mass and its application to engineering systems;
• The student will demonstrate the ability to perform basic thermal analysis of power and refrigeration cycles, and calculate the properties of gas mixtures.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcomes: a, e

7. Brief list of topics to be covered

• Subject of Thermodynamics: Basic Concepts and Definitions (1 week);
• Properties of Pure Substances: Vapor, Perfect Gas, Liquid and Solid Phases, and Phase Mixtures; (2 weeks).
• Work, Heat, and Energy (1 week);
• Conservation of Energy (First Law of Thermodynamics), Internal Energy, and Their Application to Engineering Systems (3 weeks);
• Second Law of Thermodynamics (2 weeks);
• Entropy and Its Applications to Engineering Systems (2 weeks);
• Thermodynamic Cycles; Gas and Vapor Power and Refrigeration Cycles; (2 weeks)
1. Course number and name
   ENGR 426: Steel Structures

2. Credits and contact hours
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. Instructor’s or course coordinator’s name
   Instructor: Jenna Wong, Assistant Professor of Civil Engineering
   Course coordinator: Wenshen Pong, Professor of Civil Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      Steel Construction Manual, 14th edition, AISC

5. Specific course information
   a. brief description of the content of the course (catalog description)
      Design of steel structures, members, and connections. Effects of loads causing flexure, shear and axial force, and their combinations on design choices. Steels and sections used in structural design. Use of design specifications.
   b. prerequisites or co-requisites
      ENGR 323: Structural Analysis
   c. indicate whether a required, elective, or selected elective course in the program
      Elective for Civil Engineering

6. Specific goals for the course
   a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      - The student will demonstrate a knowledge of structural stress-strain curves.
      - The student will demonstrate a knowledge of steel behavior when subjected to bending, axial load and torsion.
      - The student will demonstrate a knowledge of whether optimum design has been achieved.
      - The student will demonstrate a knowledge of steel structural design procedures.
      - The student will demonstrate a knowledge of the design method: Load & Resistant Factor Design.
      - The student will demonstrate knowledge of the design of columns.
• The student will demonstrate knowledge of the design of beams.
• The student will demonstrate knowledge of the design of connections.
• The student will demonstrate knowledge of the design of composite beams. The student will demonstrate skill in solving practical engineering problems through project assignments.
• The student will demonstrate an understanding of the design building codes and the background of codes.
• The student will demonstrate skill in applying codes and specifications to design steel structural members.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): a, c, e, f, h, i, k

7. Brief list of topics to be covered

• Principles of structural design
• Steel and properties
• Tension members
• Compression members: Columns
• Structural fasteners
• Welding
• Beams
• Combined bending and axial load
• Connections
• Composite steel-concrete construction
1. **Course number and name**
   ENGR 427: Wood Structures

2. **Credits and contact hours**
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**
   Instructor: Wenshen Pong, Professor of Civil Engineering
   Course coordinator: Wenshen Pong, Professor of Civil Engineering

4. **Text book, title, author, and year**
   
   *other supplemental materials*

5. **Specific course information**
   a. **brief description of the content of the course (catalog description)**
   Design procedures and specifications of wood members subjected to tension, compression, flexure and combined bending and axial forces. Design building codes and seismic provisions of wood structures.

   b. **prerequisites or co-requisites**
   ENGR 323: Structural Analysis

   c. **indicate whether a required, elective, or selected elective course in the program**
   Elective for Civil Engineering

6. **Specific goals for the course**
   a. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      - The student will demonstrate knowledge of wood structural design criteria. The student will demonstrate knowledge of wood structural behavior when wood is subjected to bending, axial load and torsion.
      - The student will demonstrate knowledge of whether optimum design has been achieved.
      - The student will demonstrate knowledge of wood structural design procedures.
      - The student will demonstrate knowledge of the Allowable Stress Design method.
• The student will demonstrate knowledge of the design of columns.
• The student will demonstrate knowledge of the design of beams.
• The student will demonstrate knowledge of the design of connections.
• The student will demonstrate knowledge of the design of shear walls.
• The student will demonstrate skill in solving practical engineering problems through project assignments.
• The student will demonstrate an understanding of the design building codes and the background of codes.
• The student will demonstrate skill in applying codes and specifications to design wood structural members.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, e, f, i, k.

7. Brief list of topics to be covered
• Principles of structural design
• Properties of wood and its use as engineering material
• Design loads
• Beam design
• Column design
• Wood connections
• Plywood panels
• Horizontal diaphragms
• Combined bending and axial load
• Shear walls
• Nailed and stapled connections.
• Seismic design provisions
1. **Course number and name**

   ENGR 431 Foundation Engineering

2. **Credits and contact hours**

   3 Credit Hours

3. **Instructor’s or course coordinator’s name**

   Instructor: T.B. D’Orazio, Professor of Civil Engineering
   Course coordinator: T.B. D’Orazio, Professor of Civil Engineering

4. **Text book, title, author, and year**


   a. other supplemental materials
   None.

5. **Specific course information**

   a. brief description of the content of the course (catalog description)

   b. prerequisites or co-requisites
   Engr 430

   c. indicate whether a required, elective, or selected elective course in the program
   Elective for Civil Engineering.

6. **Specific goals for the course. Specific outcomes of instruction.**

   Students will demonstrate an ability to:
   • Determine active earth pressure for walls.
   • Determine passive earth pressure for walls.
   • Design retaining walls under a variety of conditions.

   Students will demonstrate an ability to:
   • Analyze the bearing capacity of shallow foundations (mat and spread footings).
   • Evaluate stresses on shallow foundations.
   • Design shallow foundations.
   • Determine the capacity of deep foundations (piers and piles).
   • Evaluate the settlement of deep foundations.
   • Design deep foundations.
   • Select and design an appropriate foundation scheme for particular soil (environmental) conditions.
   • Evaluate undrained strength.
   • Evaluate drained strength.
   • The role of geotechnical engineers on a construction project and how they interact with owners, architects, structural engineers, contractors and others.
   • Contemporary issues in geotechnical engineering.
   • The professional and ethical responsibilities of a geotechnical engineer.
   • The need for working with other disciplines in solving geotechnical engineering problems.
   • The need for continued learning in geotechnical engineering after graduation.
b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, e, f, g.

7. Brief list of topics to be covered
   • Determining settlement of structures built on mat, footing, pile and pier foundations.
   • Determining active earth pressure for frictionless walls.
   • Determining passive earth pressure for frictionless walls.
   • Designing gravity retaining walls.
   • Designing cantilever retaining walls.
   • Designing braced excavations.
   • Designing anchored sheet pile walls.
   • Analyzing the bearing capacity of shallow foundations (mat and spread footings).
   • Analyzing the bearing capacity of deep foundations (piles and piers).
   • Designing shallow foundations.
   • Designing deep foundations.
   • Selecting an appropriate foundation scheme for particular soil (environmental) conditions.
   • Understanding the importance of geotechnical engineering in society and the engineering community.
1. **Course number and name**
   ENGR 435 Environmental Engineering Design

2. **Credits and contact hours**
   3 units. Two 75-minutes or three 50-minutes lecture per week.

3. **Instructor’s or course coordinator’s name**
   Instructors: Elahe Enssani, Ph.D., P.E.
   
   Course coordinator: Elahe Enssani, Ph.D., P.E., and Associate Professor of Civil Engineering

4. **Text book, title, author, and year**

   **b. other supplemental materials**
   • Class slides from ILearn

5. **Specific course information**
   **d. brief description of the content of the course (catalog description)**
   Introduction to conceptual design for cleaning up the environment using the fundamentals of chemistry, physical chemistry, such as conservation of mass, conservation of energy, chemical kinetics and microbial kinetics for degradation of pollutants. Concepts in water quality, process design, process flow regimes will be taught through teaching the design of wastewater treatment and biosolids digestion facilities. The students will take the class with only fresh person chemistry and calculus II as the prerequisite. A review of water quality parameters, criteria and wastewater characteristics will be done to familiarize the students with the concepts with discussion on planning, design and construction of Infrastructure projects and their impact on the environment through a review of California Environmental Quality Act (CEQA) and emerging issues such as Financing to upgrade aging infrastructures through establishment of Infrastructure Banks.

   **e. prerequisites or co-requisites**
   CHEM 115 or 180 (Chemistry)

   **f. indicate whether a required, elective, or selected elective course in the program**
   Elective for Civil Engineering.
6. **Specific goals for the course**
   c. **specific outcomes of instruction**, *ex. The student will be able to explain the significance of current research about a particular topic.*
      - The student will demonstrate an ability to analyze simple environmental processes.
      - The student will demonstrate an ability to design simple environmental systems.
      - The student will demonstrate a knowledge of the common environmental treatment systems’ design parameters such as suspended solids, BOD, etc.
      - The student will demonstrate a knowledge of the common water treatment processes such as filtration and color removal.
      - The student will demonstrate a knowledge of the design of the biological treatment systems.
      - The student will demonstrate a knowledge in the anaerobic systems for wastewater and sludge.
      - The student will demonstrate an understanding of the differences between aerobic and anaerobic systems.
      - The student will demonstrate an understanding of the design and operational parameters for both anaerobic and aerobic systems.
      - The student will demonstrate an understanding of the analysis to obtain the operational concepts for both aerobic and anaerobic systems.

   d. **explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**
   
   Course addresses ABET Student Outcome(s): b, c, d, e and i.

7. **Brief list of topics to be covered**
   - Introduction to Environmental Systems
   - Basic design considerations for Environmental systems
   - Fundamentals of Mass Balance
   - Fundamentals of Energy Balance
   - Review of Basic Chemistry as it relates to the environmental systems
   - Review of Basic Physical/Chemistry as it relates to the environmental systems
   - Review of Basic Chemical Kinetics as it relates to the environmental systems
   - Fundamentals of Process Design
   - Fundamentals of ideal flow regimes
   - Physical operations versus chemical processes in environmental design
   - Review of aquatic biology as it relates to environmental processes
   - Wastewater characterization, Oxygen Deficit equations
   - BOD, COD
   - Waste water treatment process design as example of process design
   - Primary Treatment
   - Secondary treatment: Biological Treatment Design: Suspended Growth: Activated Sludge
   - Biological treatment: Suspended Growth: Waste water treatment ponds
   - Biological treatment: Attached Growth: Trickling Filters
   - Sedimentation and sludge settling: Stokes’ law
   - Biosolids digestion: Anaerobic Biological Growth
1. **Course number and name**  
   ENGR 439: Construction Engineering

2. **Credits and contact hours**  
   3 credit hours; three 50-minute lecture sessions/week, or two 75-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**  
   Instructor: Ghassan Tarakji, Professor of Civil Engineering  
   Course coordinator: Ghassan Tarakji, Professor of Civil Engineering

4. **Text book, title, author, and year**  

   **Recommended Reference**  

5. **Specific course information**  
   a. **brief description of the content of the course (catalog description)**  
      Topics in construction engineering; construction methods and equipment, excavating, loading, hauling, and finishing; production of construction materials; compressed air and water systems; concrete form design; quality control.

   b. **prerequisites and/or co-requisites**  
      ENGR 309: Mechanics of Solids
      ENGR 430: Soil Mechanics (co-requisite)

   c. **indicate whether a required, elective, or selected elective course in the program**  
      Elective in Civil Engineering

6. **Specific goals for the course**  
   a. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
      • The student will demonstrate an understanding of the characteristics of the construction industry.  
      • The student will show familiarity with current issues pertaining to the construction industry.  
      • The student will demonstrate an understanding of soil properties and characteristics.
• The student will demonstrate the ability to calculate production rates of various construction equipment.
• The student will demonstrate an understanding of the design of concrete formwork.
• The student will demonstrate an understanding of QC/QA and the application of acceptance plans in construction projects.
• The student will demonstrate an understanding of commonly used construction materials and equipment, and the ability to design certain construction systems.

• The student will conduct research on one aspect of construction engineering and management of his/her choosing and be ready to present the findings to the class.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s):

N/A

7. Brief list of topics to be covered
• Characteristics of the construction industry
• Earthmoving materials and operations
• Excavating equipment
• Loading and hauling equipment
• Cranes and lifting equipment
• Miscellaneous construction equipment
• Air and water systems
• Asphalt and bituminous concrete
• Concrete mix design
• Concrete form design
• Quality control
1. **Course number and name**  
   ENGR 441: Fundamentals of Composite Materials

2. **Credits and contact hours**  
   3 credit hours: two 75-minute lecture sessions/week

3. **Instructor’s or course coordinator’s name**  
   Instructor: Kwok Siong Teh, Associate Professor of Mechanical Engineering  
   Course coordinator: Kwok Siong Teh, Associate Professor of Mechanical Engineering

4. **Text book, title, author, and year**  
   (No textbook)

   c. **other supplemental materials**  
      (none)

5. **Specific course information**  
   g. **brief description of the content of the course (catalog description)**  

   h. **prerequisites or co-requisites**  
      Math 245: Elementary Differential Equations & Linear Algebra, and  
      Engr 309: Mechanics of Solids

   i. **indicate whether a required, elective, or selected elective course in the program**  
      Upper Division Technical Elective for Civil Engineering and Mechanical Engineering

6. **Specific goals for the course**  
   g. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
      - The student will demonstrate an ability to describe and solve problems on atomic arrangements, geometry of imperfections, and atomic diffusion in solids.
      - The student will demonstrate an ability to describe and solve problems on mechanical and electrical behavior of materials.
      - The student will demonstrate an ability to submit homework solutions in proper engineering format.
      - The student will demonstrate an ability to describe and solve problems on the distinguishing properties of metals, plastics and ceramics.
• The student will demonstrate a familiarity with the effects of thermal, mechanical, and chemical treatments on properties.
• The student will demonstrate an ability to experimentally determine mechanical and electrical properties of materials.
• The student will demonstrate an ability to make oral presentations and write a technical report.

h. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, b, c, d, e, g, h, i, j, k.

7. Brief list of topics to be covered
   • Introduction to composites: nomenclature, definitions, advantages, applications.
   • Fiber Materials (polymer, metal, ceramic, carbon)
   • Matrix Materials (polymer, metal, ceramic, carbon)
   • Stress-Strain Tensors and Transformation
   • Long Fiber-Reinforced Lamina: Mechanical Properties
   • Long Fiber-Reinforced Laminate Plate Theory and Design
   • Strength Theories
   • Manufacturing Processes
   • Test Methods
   • Aligned and Non-Aligned Short Fiber-Reinforced Composites
   • Failure Modes - Fracture, Fatigue, Delamination
   • Thermomechanical Properties
   • Sandwich Panels
   • Particle-Reinforced Composites
   • Metal and Ceramic Matrix Composites
   • Nanocomposites
   • Case Studies and Applications
1. **Course number and name**

   **ENGR 461: Mechanical and Structural Vibration**

2. **Credits and contact hours**

   3 credit hours; two 75-minute lecture sessions/week

3. **Instructor’s or course coordinator’s name**

   Instructor: Cheng Chen, Associate Professor of Civil Engineering

   Course coordinator: Cheng Chen, Associate Professor of Civil Engineering

4. **Text book, title, author, and year**


   a. **other supplemental materials**


5. **Specific course information**

   a. **brief description of the content of the course (catalog description)**

      Dynamic excitation and response of mechanical and structural systems; time domain analysis; D'Alembert's principle; modal analysis; vibration damping; resonance and tuned mass damper.

   b. **prerequisites or co-requisites**

      ENGR 201, ENGR 309 and MATH 245.

   c. **indicate whether a required, elective, or selected elective course in the program**

      Selected elective for Civil and Mechanical Engineering.

6. **Specific goals for the course**

   a. **specific outcomes of instruction.**

      - Student understands basic concepts of mass, stiffness, and damping for a SDOF system.
      - Student is able to determine the mass and stiffness for a SDOF system using dynamic equilibrium.
      - Student is able to obtain system damping using log decrement from free vibration test.
      - Student is able to generate the free vibration response to an impact load.
• Student is able to generate the steady-state response due to a harmonic load or ground motion.
• Student can determine the transient vibration to shock loads and earthquake motion.
• Student can determine maximum response using response spectra.
• Student can use dynamic equilibrium to create the differential equation of motion for a MDOF system, thus determining mass and stiffness matrices.
• Student can obtain stiffness and flexibility matrices using influence coefficients.
• Student can obtain modal frequencies and mode shapes.
• Student can obtain steady-state solutions for harmonic loads using modal analysis.
• Student can obtain transient solutions and maximum responses for non-harmonic loads using modal analysis.
• Student understands the concept of using a vibration absorber to eliminate excessive vibrations when SDOF systems are subjected to input frequencies at or near resonant frequency.
• Student can select the stiffness and mass for a vibration absorber.

b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

Course addresses ABET Student Outcome(s): a, c, e, i.

7. *Brief list of topics to be covered*

- Introduction to vibration
- Derivation of equation of motion
- Free body diagram
- D' Alembert's Principle
- Natural frequency and damping ratio
- Free vibration of undamped single-degree-of-freedom system
- Free vibration of damped single-degree-of-freedom system
- Forced vibration of undamped single-degree-of-freedom system
- Forced vibration of damped single-degree-of-freedom system
- Resonance
- Half-power rule
- Transient and steady-state response
- Equation of motions for multiple-degree-of-freedom system
- Vibration modes
- Vibration control through tuned mass damper
1. **Course number and name**
   ENGR 468: Applied Fluid Mechanics and Hydraulics

2. **Credits and contact hours**
   3 credit hours; two 75-minutes or three 50-minutes lecture per week.

3. **Instructor’s or course coordinator’s name**
   Instructor: Dragomir Bogdanic, Instructor
   Course coordinator: Elahe Enssani, Associate Professor

4. **Text book, title, author, and year**
   
   **d. other supplemental materials**
   Additional references:

5. **Specific course information**
   **j. brief description of the content of the course (catalog description)**
   Fluid mechanics: incompressible flow to steady and transient flow problems in piping networks, turbo-machines, and open channels.

   **k. prerequisites or co-requisites**
   ENGR 304

   **l. indicate whether a required, elective, or selected elective course in the program**
   Elective for Civil Engineering; elective for Mechanical Engineering

6. **Specific goals for the course**
   **e. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
   - The student will be able to specify appropriate pumps for piping systems based upon pump and system curves
   - The student will be able to analyze and design pipe networks
   - The student will be able to understand the characteristics and basic design considerations associated with turbo-machines
   - The student will be able to analyze and design open channels
   - The student will be able to carry out analysis of surface-water hydrology

   **f. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.**
7. Brief list of topics to be covered

- Review of fluid mechanics
- Flow in closed conduits
- Multiple pipelines
- Pumps
- Flow in open channels
- Water surface profiles
- Hydraulic structures
- Surface-water hydrology
1. Course number and name
   ENGR 469: Alternative and Renewable Energy Systems

2. Credits and contact hours
   2 unit. Three 50-min or two 1-hr 15 min lectures per week.

3. Instructor’s or course coordinator’s name
   Instructor: Ed Cheng, Associate Professor
   Course coordinator: Ed Cheng, Associate Professor

4. Text book, title, author, and year

   e. other supplemental materials
      Various references and online material delivered via iLearn.

5. Specific course information
   m. brief description of the content of the course (catalog description)
      Theory and practical applications of renewable energy systems, including solar, hydro, and wind power. Biomass and biofuels. Environmental, social, and economic factors related to energy conversion processes.

   n. prerequisites or co-requisites
      ENGR 303.

   o. indicate whether a required, elective, or selected elective course in the program
      Elective for Civil Engineering; elective for Mechanical Engineering.

6. Specific goals for the course
   g. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
      - Identify the types and relative amounts of energy sources currently being used.
      - Understand the fundamentals and principal environmental impacts of conventional energy conversion processes.
      - Calculate direct solar irradiance based upon latitude and time.
      - Conduct basic engineering analyses of solar thermal systems used for both heating and electricity generation.
      - Understand the principles of photovoltaic electricity generation.
      - Assess the power available in stored water, given the elevation difference.
      - Perform basic calculations related to impulse and reaction hydro-turbines.
• Assess the power available in the wind, given the velocity or elevation and wind characteristic data.
• Understand aerodynamic design considerations with respect to wind turbine blade design.
• Identify the feedstocks, production methods, and life-cycle considerations associated with biomass and biofuels.
• Carry out basic energy and energy density calculations associated with biomass and biofuels.
• Calculate the energy available in waves given wave parameters or wave characteristic data.
• Identify the basic design characteristics and components associated with various practical renewable energy conversion devices.
• Identify the operation and energy storage density of various energy storage devices.
• Assess the relative environmental and economic impact of different renewable energy systems.
• Research a technical topic related to renewable energy systems and present the information to the class in an effective manner.

h. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
Course addresses ABET Student Outcome(s): a, c, e, g, h, j, k.

7. Brief list of topics to be covered
• Thermodynamics, fluid mechanics, and physics review
• Energy and the environment (including climate change issues) – petroleum and non-petroleum energy resources, energy consumption of developed vs. developing countries, regulated pollutants, CO2 and other global warming gases, importance of energy efficiency
• Solar power – characteristic of solar radiation, direct solar heating, and photovoltaic technologies
• Hydro power – fundamental energy analysis and types of hydro-turbines
• Wind power – review of wind turbine designs and performance; characteristics of the wind
• Nuclear power – brief overview of nuclear power and options for nuclear waste storage/disposal
• Biomass fuels – including ethanol, biodiesel, solid biomass fuels; discussion of different biomass feedstocks
• Geothermal power
• Wave and tidal power
• Fuel cells and hybrid vehicles
• Carbon sequestration
• Energy storage systems
• Life-cycle analyses
1. **Course number and name**  
ENGR 610: Engineering Cost Analysis

2. **Credits and contact hours**  
3 credit hours; three 50-minute lecture sessions/week, or two 1hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**  
Instructor: Mutlu Ozer, Adjunct Professor  
Course coordinator: Ghassan Tarakji, Professor of Civil Engineering

4. **Text book, title, author, and year**  

5. **Other supplemental materials**  
none

**Specific course information**  
**p. brief description of the content of the course (catalog description)**  
Quantifying alternatives for decision making, time-value of money, project investment evaluation, comparison of alternatives, and engineering practice applications.

6. **Prerequisites or co-requisites**  
ENGR 103: Introduction to Computers or CSC 210: Introduction to Computer Programming  
Math 227: Calculus II (Techniques of integration, analytic geometry, polar coordinates, vectors, improper integrals. Sequences and series.)

**Specific goals for the course**  
**i. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**  
- The student will demonstrate an understanding of interest formulas and their application.  
- The student is able to apply the principles of rate of return (ROR), incremental ROR, benefit/cost ratios (B/C), incremental B/C, and replacement analysis in order to compare alternatives for decision making.  
- The student is able to identify and quantify variables, and formulate problems for decision making.
• The student will demonstrate the ability to determine how deviations from the assumptions used in solving a problem will affect the conclusions obtained.
• The student will demonstrate an understanding of inflation and how to take it into account when doing economic analysis.
• The student will demonstrate an understanding of the common depreciation models used, and the ability to apply these models in practical cases.
• The student will demonstrate the ability to calculate corporate taxes, and to calculate after-tax returns.

\textit{j. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.}

Course addresses ABET Student Outcome(s):

N/A

7. Brief list of topics to be covered
2. Quantifying costs and benefits
3. Interest formulas and their application
4. Rate of return computations
5. Comparison of alternatives
6. Benefit/Cost ratio
7. Replacement analysis
8. Inflation
9. Taxation and after-tax cash-flow
10. Break-Even analysis
11. Review and case studies
APPENDIX B

FACULTY VITAE
1. Name
   Cheng Chen

2. Education
   Ph.D. in Structural Engineering, Lehigh University, 2007
   M.S. in Structural Engineering, Tongji University, 2002
   B.S. in Civil Engineering, Tongji University, 1999

3. Academic experience
   Associate Professor, SFSU, 2015- present (FT)
   Assistant professor, SFSU, 2009 – 2015 (FT)
   Lehigh University, post-doctoral research associate, 2007-2009 (FT)

4. Non-academic experience
   N/A

5. Certifications or professional registrations
   EIT

6. Current membership in professional organizations
   American Society of Civil Engineers (ASCE)
   American Society of Engineering Education (ASEE)
   American Institute of Steel Construction (AISC)
   Earthquake Engineering Research Institute (EERI)

7. Honors and awards
NSF-MRI Grant: MRI: Acquisition of a Temperature-controlled Probe Station and Semiconductor Parameter Analyzer to Enhance Research and Research Training in Engineering and Physics at SFSU, 2010-2013, Co-PI $262,234.

DOE Grant: Cooperative HSI STEM and Articulation Programs Proposal California Alliance for the Long-term Strengthening of Transfer Engineering Programs (CALSTEP) between Cañada College, San Francisco State University, and Los Angeles Pierce College, Co-PI of San Francisco State University, 2011-2015, $687,388.


Wang Family Faculty Award, California State University, 2012-2013

San Francisco State University Presidential Award, 2012

8. Service activities

Faculty Advisor for SFSU Engineering Societies Advisory Board (August 2014 - present)
Faculty Advisor for SFSU EERI Seismic Competition Team (May 2010 - present)
Faculty Advisor for ASCE SFSU Student Chapter (August 2009 - 2016)
Search Committee Chair for Civil Engineering Faculty Position (May 2015 - August 2016)
Search Committee Chair for Civil Engineering Faculty Position (May 2013 - August 2014)
Search Committee Member for Department Equipment Technician (May 2010 - August 2010)
Faculty Advisor for SFSU AISC Steel Bridge Competition Team (August 2009 - May 2010)
Faculty Advisor for SFSU Concrete Canoe Team (August 2009 - May 2010)
Faculty Advisor for SFSU Timber Bridge Team (August 2009 - May 2010)

Most important publications and presentations from the past five years


Most recent professional development activities

Member, ASCE/SEI Structure Control and Sensing Committee, 2009 - present

Member, ASCE/SEI Seismic Effects Committee, 2010 - present

Member, ASCE/SEI Subcommittee on Experimental Methods, 2011 – 2014


Session Chair, Real-Time Hybrid Simulation, *Structures Congress*, Boston, MA, 2014.
1. Name
   Timothy B. D’Orazio

2. Education
   Ph.D. in Civil Engineering, University of California Berkeley, 2011
   M.S. in Civil Engineering, University of Michigan, 1976
   B.S. in Civil Engineering, University of Michigan, 1975

3. Academic experience
   Professor, SFSU, 1990-present
   Associate Professor, SFSU, 1984-1990

4. Non-academic experience
   Visiting Scientist, Norwegian Geotechnical Institute Summers 1985-1995
   Visiting Scientist, Public Works Research Institute, Japan 1991
   Post Doctoral Researcher, Norwegian Geotechnical Institute, 1982-1984
   Consultant on numerous projects including Prirazlomnoye soil investigation, La Esperanza Dam,
   Europipe slope stability, Platform foundation design Malaysia, Platform Gulf of Mexico, High
   rise foundation design Malaysia, Foundation studies for various offshore structures Norway,
   Kansai airport Japan

5. Certifications or professional registrations
   Registered Professional Engineer: California, License No. 29120

6. Current membership in professional organizations
   American Society of Civil Engineers (ASCE)

7. Honors and awards
   Arthur M. Wellington Prize, ASCE, 1987
   National Science Foundation –Fellowship for research in Japan, 8 months, 1991
   (approx.$40,000)
   Norwegian Geotechnical Institute Fellowship, 1984
8. Service activities
   Head of Civil Engineering, 2008 to present

   Multiple search committees

   Multiple years on Hiring, Retention, Tenure Committee

   Multiple years on Promotion Committee

   Multiple years on Election Committee

   Reviewer for Journal of Geotechnical and Geoenvironmental Engineering

9. Briefly list the most important publications and presentations from the past five years

10. Briefly list the most recent professional development activities
    Civil Engineering Department Heads meetings

    ABET informational meetings
1. Name:
   ELAHE ENSSANI, Ph.D., P.E.,

2. Education:
   Ph.D., Civil Engineering, Department of Civil Engineering, Division of Environmental Engineering, University of California, Berkeley, California, December 1987.

   Master of Engineering, Civil Engineering, Department of Civil Engineering, Division of Environmental Engineering, University of California, Berkeley, California, June 1980. Highest honor in comprehensive exam.

   M.S., Chemical Engineering, University of California, Berkeley, California, December 1978.

   B.S., Chemical Engineering, Sharif (Aryamehr) University of Technology, Tehran, Iran, February 1976. Highest honor.

3. Academic Experience:
   School of Engineering, Civil Engineering Program, San Francisco State University, Associate Professor, 1998-Present

   School of Engineering, Civil Engineering Program, San Francisco State University, Assistant Professor, 1993-1995

4. Non-academic Experience:

   City & County of San Francisco, Office of the Chief Administrative Officer, Assistant to Chief Administrator Officer, 1990-1993.

   Dames & Moore (Currently URS), San Francisco, California, Project Manager, 1987-1990.

   Technip Engineering, Tehran, Iran, Staff Engineer, 1974-1975.

5. Certificates or Professional Registration
   Professional Engineer in Sanitary Engineering, State of Arizona.
6. Current Membership in Professional Organizations

American Society of Civil Engineers
American Institute of Chemical Engineers
Iranian –American Chamber of Commerce (Founding Member), San Francisco Bay Area
American Association for the Advancement of Science (AAAS)
National Iranian American Council (NIAC)

7. Honors and Awards


"Professional Excellence Award for Services to Environmental Engineering ".
American Institute of Chemical Engineers, Berkeley, California, May 2000.


First Prize Winner for best paper in California Engineer, University of California, Berkeley's College of Engineering student magazine, February 1986.

College of Engineering Distinguished Teaching Assistant Award for 1984
1985, University of California, Berkeley.

8. Service Activities Within and Outside the Institution
   At School of Engineering: Served on various committees the latest one was to conduct the mid-term review of the Director of the School of Engineering. Faculty Advisor to the Iranian Students Cultural Club.

   Outside School of Engineering and SFSU:
   Commissioner, Immigrant Rights Commission, City and County of San Francisco, 2005-Present.
   Board of Director, National Iranian American Council (NIAC). 2006-2008.
   Board of Directors, Affordable Housing Association, (a non-profit organization dedicated to building and managing housing for low-income tenants), 2001.
   Nominated by City of San Francisco’s then-Mayor Willie Brown as one of the fifty most influential women in Bay Area, May 2001.
   Contributing Editor, Flowsheet, a Publication of the American Institute of Chemical Engineers.1995-2002.
   Mentor, University of California Berkeley Environmental Engineering Student/Faculty Mentorship Program, 1994.
   President, American Institute of Chemical Engineers, NorCal, 1994-1995.
   Vice President, Secretary, Treasurer, Director –at- Large, American Institute of Chemical Engineers, 1989-1994.
   Symposium Chairperson, American Institute of Chemical Engineers (AICHE), Northern California Section. Symposium Theme: "Environmental Concerns of the 90s: A Partnership of Industry, Academia and Government", Berkeley, March 19, 1991.
1. Name
   Zhaoshuo Jiang

2. Education
   Ph.D. in Civil/Structural Engineering, University of Connecticut, 2012
   M.E. in Civil/Structural Engineering, University of Connecticut, 2008
   B.S. in Civil Engineering, Guangzhou University, 2003

3. Academic Experience
   Assistant Professor, San Francisco State University, 2014 – present (FT)

4. Non-Academic Experience
   Structural Engineer, San Francisco, CA, 2012 – 2014 (FT)
   Research Assistant, Connecticut, CT, 2006 – 2012 (PT)
   Structural Engineer, Guangzhou, China, 2003 – 2006 (FT)

5. Certifications or Professional Registrations
   Registered Professional Engineer (PE): California, License No: C 82335
   Registered Professional Engineer (PE): Connecticut, License No: PEN.0028077
   Leadership in Energy & Environmental Design (LEED) AP BD+C, License No: 10905579-AP-BD+C

6. Current Membership in professional Organizations
   American Society of Civil Engineers (ASCE)
   American Society for Engineering Education (ASEE)
   American Institute of Steel Construction, Inc. (AISC)
   Earthquake Engineering Research Institute (EERI)
   Structural Engineers Association of California (SEAOC)
   The George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES)

7. Honors, Grant and Awards
   Course Redesign with Technology – Virtual Labs: Development of Real-time Mobile Remote Shake Table Laboratory, California State University Chancellor’s Office, PI $17,966, 06/16 – 06/17.

   High-rise Building Design through Integrated Optimization and Smart Dampers, San Francisco State University Office of Research and Sponsored Programs, PI $12,500, 07/2016 – 09/2017.

   Integrated e-Learning Modules Mini-Grant: Delivering an Elevator Pitch, The University of New Haven as part of the grant funded by the Kern Family Foundation and supported by the Kern Entrepreneurial Engineering Network (KEEN), $2,750, 06/2016 – 01/2017.
Mobile Interactive Shake Table Laboratory through qdex™ Mobile Development Platform, Quanser Inc., PI $129,000, 09/2016 – 09/2018.

Cañada College and San Francisco State University Cooperative Minority Science and Engineering Improvement Program (MSEIP): Accelerated STEM Pathways through Internships, Research, Engagement, and Support (ASPIRES), U.S. Department of Education, Co-PI $900,000, 10/15 - 09/18.

8. Institutional and Professional Service in last five years

Secretary and founding member of ASCE Structural Engineering Institute (SEI) San Francisco Chapter; Committee member of ASCE SEI Structural Control and Sensing Committee, ASCE Engineering Mechanics Institute (EMI) Dynamics Committee and ASCE EMI Structural Health Monitoring & Control Committee.

Session Chair, Broadening Participation in Engineering and Engineering Technology Session, 2016 ASEE 123rd Annual Conference & Exposition, New Orleans, LA, 2016.

Session Chair, Structural Control Session, 2015 AESE/ANCRiSST Joint Conference, Urbana-Champaign, IL, 2015.

9. Principal Publications and Presentations in last five years (over 30 papers available)


10. Most Recent Professional Development Activities
   Attended and/or presented in various professional conferences and various workshops:

   68th EERI Annual Meeting, San Francisco, CA, April 5-8, 2016

   US-China Tall Building Symposium, Stanford University, April 22, 2016

   CSU Course Redesign with Technology Summer Institute, June 19-24, 2016.

   123rd ASEE Annual Conference & Exposition, New Orleans LA, June 26-29, 2016

1. Name
   Wenshen Pong

2. Education
   Ph.D. in Civil/Structural Engineering, State University of New York at Buffalo, 1994
   M.E. in Civil/Construction Engineering, State University of New York at Buffalo, 1989
   B.S. in Civil Engineering National, Chiao-Tung University, Taiwan, 1985

3. Academic Experience
   Director, SFSU, 2009-present
   Professor, SFSU, 2006-present (FT)
   Associate Professor, SFSU, 2002-2006 (FT)
   Assistant Professor, SFSU, 1998-2002 (FT)

4. Non-Academic Experience
   Structural Engineer, 1994-1998
   Structural Design Engineers, San Francisco, California (FT)
   Research/Graduate Assistant, 1989-1994
     National Center for Earthquake Engineering Research (PT)
     State University of New York at Buffalo.
   Civil Engineer/Programmer, 1985-1987
     China Engineering Consultants, Taipei, Taiwan (FT)

5. Certifications or Professional Registrations
   Registered Professional Engineer: California, License No. C 057560

6. Current Membership in professional Organizations
   American Society of Civil Engineers (ASCE)
   American Society for Engineering Education (ASEE)
   Structural Engineers Association of California (SEAOC)
   American Institute of Steel Construction, Inc. (AISC)
   Network for Earthquake Engineering Simulation (NEES)

7. Honors, Grant and Awards
   Department of Education, Canada College and San Francisco State University Cooperative Minority Science and Engineering Improvement Program (MSEIP), total grant funding $900,000, of which $182,220 was awarded to SFSU, 2015-2018.

   Department of Education, Canada College and San Francisco State University, HSI-STEM grant, total grant funding $6 Million dollars, of which $687,388 was awarded to SFSU, 2011-2016.

   NASA-CiPar, partnered with Canada College, total grant funding $450,000, of which $120,000 was awarded to SFSU, 2010-2013.

   “Scholarships for Success in Engineering Excellence” funded by the National Science Foundation, S-STEM program, Proposal No. 0848492, $598,840, 2009-2013
Department of Education, Canada College and San Francisco State University Cooperative Minority Science and Engineering Improvement Program (MSEIP), total grant funding $900,000, of which $279,042 was awarded to SFSU, 2008-2011.

NASA Administrator’s Fellowship Faculty Research Award, $25,000, 2008-2009

NASA-Administrator’s Fellowship Program Award, $166,040, 2007-2009

“Integrated Undergraduate Structural Engineering,” funded by the National Science Foundation, the Course Curriculum and Laboratory Improvement (CCLI), NSF 03-598, $135,567, 2004-07

8. Institutional and Professional Service in last five years


The All-University Committee on International Programs, 2013-2016

President, Chinese American Faculty and Staff Association, SFSU, 2014-present

9. Principal Publications and Presentations in last five years (over 35 papers available)


10. Professional Development Activities in last five years

Attended and/or presented in various professional development workshops and training sessions.
1. Name
   **Ghassan Tarakji**

2. Education
   Ph.D. in Civil Engineering, Clemson University, South Carolina. 1983
   M.E. in Civil Engineering, University of Florida, Florida. 1980
   B.E. in Civil Engineering, American University of Beirut, Lebanon. 1978

3. Academic Experience
   Professor, SFSU, 1993-present (FT)
   Associate Professor, SFSU, 1990-1993 (FT)
   Assistant Professor, SFSU, 1986-1990 (FT)
   Visiting Professor, AUC (Egypt), 1996-1997 (FT)
   Assistant Professor, FSU-FAMU, 1983-1986 (FT)
   Interim Chair, Civil Engineering, FSU-FAMU, 1983-1984
   PE License Review Course, Caltrans, 1988

4. Non-Academic Experience
   Consulting Engineer, InteliSys Advisors, 1990 - present
   Site Engineer, OTAC Contracting, Dubai, UAE, 1978-1979

5. Certifications or Professional Registrations
   Registered Professional Engineer: California, License No. C 44381
   Registered Professional Engineer: Florida. (currently inactive)

6. Current Membership in professional Organizations
   American Society of Civil Engineers (ASCE)
   Construction Institute (Northern California)

7. Honors, Grant and Awards
   None

2. Institutional and Professional Service in last five years
   Chair, Promotions Committee, School of Engineering 2015 – Present
   Chair, RTP Committee, School of Engineering 2014 – 2015
   Earthquake Response Engineering Volunteer 1988 to Present
   Academic Advisor to more than 25 undergraduate students
3. Principal Publications and Presentations in last five years:


https://www.researchgate.net/publication/291020208_THE_DRIVERS%27_ATTITUDES_AT_GATED_RAILROAD-HIGHWAY_CROSSINGS_IN_CALIFORNIA


https://www.researchgate.net/publication/291020531_CONCEPTUAL_REQUIREMENTS_AND_RECOMMENDATIONS_FOR_ENHANCING_SAFETY_AT_GATED_RAIL-HIGHWAY_CROSSINGS


4. Professional Development Activities in last five years

- Trimble - Caterpillar Demo Days, Pleasanton, CA, May 24 – 25, 2017
1. Name
   Jenna Wong

2. Education
   Ph.D. in Civil/Structural Engineering, University of California, Berkeley, 2014
   M.S. in Civil/Structural Engineering, University of California, Berkeley, 2009
   B.S. in Civil Engineering, University of California, Berkeley, 2008

3. Academic Experience
   Assistant Professor, SFSU, 2016-present (FT)
   Lecturer, SFSU, 2014-2016
   Graduate Student Instructor, UC Berkeley, 2010
   Undergraduate Student Instructor, UC Berkeley, 2008

4. Non-Academic Experience
   Geological Postdoctoral Fellow, 2015-2016
   Lawrence Berkeley National Laboratory, Berkeley, California
   Engineering Intern, 2014-2015
   AECOM/URS, San Francisco, California
   Graduate Researcher, 2009-2014
   UC Berkeley, Berkeley, California
   Student Design Trainee, 2006-2013
   San Francisco Public Utilities Commission, San Francisco, California

5. Certifications or Professional Registrations
   Registered Professional Engineer: California, License No. C83237

6. Current Membership in professional Organizations
   American Society of Civil Engineers (ASCE)
   Structural Engineers Association of California (SEAOC)
   Society of Women Engineers (SWE)
   Earthquake Engineering Research Institute (EERI)
   American Nuclear Society (ANS)
   Chinese American Institute of Engineers and Scientists (CAIES)

7. Honors, Grant and Awards
   University of California, Berkeley Chancellor Fellowship (2008)
   Honors from University of California, Berkeley College of Engineering (2005-2008)
   University of California Alumni Scholarship Leadership Award (2004-2008)
   T.Y. Lin Award from Chinese Chapter of the California Alumni Association (2006, 2007)
   Chinese-American Institute of Engineers and Scientists Scholarship (2007)
Golden Key Honor Society (2007)
Tau Beta Pi Honor Society (2007)
Chi Epsilon Honor Society (2006)
Commendation by Congresswoman Jackie Speier for Community Service Work (2004)

8. Institutional and Professional Service in last five years

Vice President and Scholarship Chair, CAIES (2014-2016)
Faculty Advisor for SFSU’s ASCE Student Chapter (2016)
Faculty Advisor for SFSU’s SASE Student Chapter (2016)

9. Principal Publications and Presentations in last five years (over 20 publications, with same listed as follow)


10. Professional Development Activities in last five years
   Attended and/or presented in various professional development workshops and training.

   • Nuclear Power Current Issues Symposium, December 11-15, 2016
   • American Nuclear Society Winter Meeting, November 6-10, 2016
   • 2016 SEAOC Convention, October 12-15, 2016
   • Scientific Leadership and Management Skills UCSF Fellow, May 2016
   • SMiRT-22 Conference, August 2013
   • PEER Annual Meeting, October 2012
1. Name

DRAGOMIR J. BOGDANIC, MS, PE.

2. Education

Bachelor of Science in Civil Engineering - San Francisco State University, California, 1992
Master of Science in Engineering - San Francisco State University, California, 1994

3. Academic Experience

San Francisco State University - Part time Lecturer August 2001 to Present
I have been teaching civil engineering classes including: engineering experimentation (ENGR-301), construction engineering (ENGR-439), construction management (ENGR-429), transportation engineering (ENGR-436), surveying (ENGR-235), and hydraulics (ENGR-468). My classes have accommodated between 26 and 80 students. All classes have included lectures, homework assignments, projects, exams, and project reports. Some classes such as engineering experimentation and surveying have included a laboratory section with various projects for students to complete.

California Department of Transportation January 1994 to Present
Since 1994 I have been training professional engineering staff, on various environmental engineering topics including but not limited to: environmental management and permit compliance, environmental monitoring, facility inspection for compliance, implementation of water pollution controls, hazardous waste management, environmental health and safety, and other professional training classes. I have trained over 3000 staff including engineers, environmental scientists, managers, and other professional staff. The training sessions have accommodated between 30 to 70 people, with class session between 4 and 8 hours.

4. Non-Academic Experience

Caltrans District 4 - Construction Environmental Engineering Support August, 2003 to Present
District Branch Chief - Full Time
I manage a work force of 16 full-time employees, including civil engineers, landscape architects and consultants. Responsible for all environmental engineering issues during construction of capital projects, including water quality, storm water, air quality, hazardous wastes, and compliance inspections. I manage a number of environmental investigations including the classification of hazardous materials and waste for disposal, emergency response, waste water treatment systems for construction, and water quality monitoring in the San Francisco Bay.

Caltrans District 4 - Office of Water Quality Feb, 2000 to Aug.2003
Senior Transportation Engineer - Full Time
Liaison between the California Regional Water Quality Control Board and Caltrans District 4, responsible for overseeing regulatory compliance and permitting issues. Managed the work of engineers, student assistants, and consultants, during the development of permit applications and special studies. I was involved with the development of guidance documents and water quality regulations at the state and local level. I managed geomorphology and water quality studies, assessed the potential environmental impact of construction projects, and developed recommendations for alternative construction methods and mitigation measures.
As a lead engineer, I provided technical direction to staff and consultants on water quality studies, monitoring, hydraulic and hydrology analyses, watershed management, and permit compliance. I developed engineering plans and specifications for drainage features and for best management practices (BMP). I developed, managed, and implemented the district’s storm water monitoring program. Prepared technical reports and participated in subsurface investigations and design of slope stabilization measures.

**Caltrans District 4 - Division of Construction Jul. 1993 to Jan. 1994**

Assistant Transportation Engineer - Full Time

As a field engineer I conducted various construction engineering and management duties. I was responsible for overseeing contractor's daily work and interpreting and enforcing project plans, specifications and design. I was responsible for quality assurance. I prepared monthly material and pay quantities. I prepared design changes for contract change orders. I maintained construction schedule and prepared daily progress reports of construction activities.

**Caltrans District 4 - Office of Project Development June, 1992 to June, 1993**

Transportation Engineer

Developed engineering plans and specifications for highway projects, including the design of horizontal alignments, profiles, cross-sections, and drainage facilities. I prepared project documentation, including earthwork calculations, material quantities, cost estimates, contractor information hand-outs, and project reports. I performed tidal flow evaluation for culvert design. I performed pavement performance evaluations. I reviewed traffic, geotechnical, and hydraulic reports for alternative selection.

5. Certifications or professional registrations
   California Registered Professional Engineer; Civil (C 56449)
   Hazardous Waste Operations and Emergency Response (Registration No.10276R)
   AHERA Asbestos Certifications

6. Current membership in professional organizations
   n/a

7. Honors and awards
   Caltrans District 4 - Superior Accomplishment Award, 2010
   SFSU, School of Engineering Alumni of the Year - 2004

8. Service activities
   Engineering Advisory Board for San Francisco State University, School of Engineering.
   Directed the Caltrans Summer Engineering Institute

9. Recent publications and presentations
   Advance Water Treatment System at Devil's Slide Project, 2009 Caltrans Statewide Stormwater Conference.
Plume mapping technology and state of the art water quality monitoring in the San Francisco Bay, 2016 Annual CASQA Conference.

10. Recent professional development activities
   Attended a training class and passed a State Water Board exam to become a Qualified Storm Water Pollution Prevention Plans (SWPPP) Developer (QSD) 2010
1. Name
   Justin Brodowski

2. Education
   M.E. in Civil/Structural Engineering, San Francisco State University, 2013
   B.S. Biology, St. Lawrence University, Canton, NY, 2006

3. Academic Experience
   Lecturer, SFSU 2013-present (PT)

4. Non-Academic Experience
   Project Engineer, Verdant Structural Engineers, Berkeley, CA, 2013-present (FT)

5. Certification of Professional Registration
   Registered Professional Engineer: California, License No. C 84943
1. NAME:
   Robert Paul Levenson

2. EDUCATION:
   Bachelor of Science in Engineering, California Polytechnic State University, San Luis Obispo, CA, June 1972.
   Master of Science in Engineering, San Francisco State University, June 2006.

3. ACADEMIC EXPERIENCE:
   San Francisco State University, Part-time Instructor, Introduction to Engineering, Fall Semester 2010 to present.
   San Francisco State University, Part-time Instructor, Steel Structures, Spring Semester 2011.

4. NON-ACADEMIC EXPERIENCE:
   Civil Engineer (Structural) - United States General Services Administration; Provides structural engineering expertise within the Pacific Rim Region of the United States, which includes California, Arizona, Nevada, Hawaii, Guam and Saipan. Responsible for assuring that privately-owned buildings that are candidates for lease to the Government as well as publically-owned buildings are structurally compliant per the Model Building Code requirements in effect. Full-time position from November 1998 to present.
   Project Engineer - Skidmore, Owings & Merrill, San Francisco, CA; a full-time position from January 16, 1995 to November 20, 1998.


Project Engineer - Skidmore, Owings & Merrill, San Francisco, CA; full-time position from January 3, 1979 to July 18, 1986.

Staff Engineer - Rutherford & Chekene, San Francisco, CA; full-time position from 1978 to 1979.

5. CERTIFICATIONS OR PROFESSIONAL REGISTRATIONS
   Registered Professional Engineer: California, License No. C27121

6. CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:
   Member of the "Structural Engineers Association of Northern California, Inc." (SEAONC) since January 1980.

   Participated in the following committees: Disaster Emergency Services, Seismology, Inspection Practice (renamed - Quality Assurance), Professional Practice:

   Vice-Chair of the SEAONC's "Inspection Practice Committee" 1992 - 1993
   Chair of the SEAONC's "Inspection Practice Committee" 1993 - 1994
   Vice-Chair of the SEAONC's "Professional Practice Committee" 1998 - 1999
   Chair of the SEAONC's "Professional Practice Committee" 1999 - 2000
   Vice-Chair of the SEAONC's "Professional Practice Committee" 2001 - 2002
   Vice-Chair of the SEAONC's "Professional Practice Committee" 2002 – 2003

7. HONORS & AWARDS
   San Francisco State University, Distinguished Achievement Award for Academic Excellence, May 26, 2005.

8. SERVICE ACTIVITIES (within and outside of the institution):
Volunteered to work as the Regional Accessibility Officer for the Federal Government whereby I provide technical expertise on accessibility compliance for the disabled per the more stringent of the International Building Code, the California Building Code or Federal requirements.

9. MOST IMPORTANT PUBLICATIONS AND PRESENTATIONS FROM THE PAST 5 YEARS
Plate Tectonics - Federal Government Seminar - March 2011
Seismic Risk in the Bay Area - Federal Government Seminar - December 2010
Accessibility Presentation, Monterey, California - Federal Government Seminar - April 2010

10. MOST RECENT PROFESSIONAL DEVELOPMENT ACTIVITIES

Seismic Connections/Manual; Practical Applications of the 2005 AISC Seismic Provisions – November 12, 2009
1. Name
   **Jonathon Fraser Tai**

2. Education
   M.S. in Civil and Environmental Engineering, University of California Berkeley, 2011
   B.S. in Civil Engineering, San Francisco State University, 2010

3. Academic experience
   Lecturer, SFSU, 2012-present (PT)

4. Non-academic experience
   Engineer, 2016-present
   Hellmuth, Obata + Kassabaum, San Francisco, California (FT)
   Engineering Design Professional - Structural, 2013-2016
   Hellmuth, Obata + Kassabau, San Francisco, California (FT)
   Graduate Intern, 2012-2013
   Earthquake Engineering Research Institute, Oakland, California (FT)

5. Certifications or professional registrations
   Registered Professional Engineer: California, License No. C 85119

6. Current membership in professional organizations
   Structural Engineers Association of Northern California (SEAONC)
   Structural Engineers Association of California (SEAOC)
   Earthquake Engineering Research Institute (EERI)
   American Institute of Steel Construction (AISC)

7. Honors and awards

8. Service activities
   Committee Member of SEAONC Sustainable Design Committee 2013-present
   Committee Member of SEAONC Continuing Education Committee 2013-present
   Team lead for Hayward softstory walking building survey (Norcal EERI) 2016
   Team lead and IT for Albany walking building survey (Norcal EERI) 2012

9. Briefly list the most important publications and presentations from the past five years

10. Briefly list the most recent professional development activities attended:
    - 2014-2017 SEAONC Fall, Spring, and Summer seminars.
    - AISC "Steel Innovations Seminar - Maximizing the Process" Dec 7, 2016
    - 2016 EERI Annual Meeting
APPENDIX C - EQUIPMENT

Surveying Lab (SCI 114) for Engr 235 The lab currently has the following equipment:

1. 5 Leitz Automatic Levels
2. 3 Leitz optical theodolites with 10" accuracy (one is in repair)
3. 3 Qualtest QTS-Series Total Stations
4. 7 4-segment fiberglass telescopic rods
5. 1 Total Station with Optical Angle reading (Leitz SDM3F)
6. 2 Total Station with Electronic Angle Reading (SOKKIA Set 5 and Set 5A)
7. 3 single lens prisms
8. 7 Tripods
9. 6 Direct Elevation roads
10. 1 tension balance scale
11. 7 16 Oz. Plumb Bobs with Gammon Reel
12. 5 Hand Levels
13. 6 Rod Levels
14. 4 3’ Measuring Wheels
15. 8 100’ Steel Tapes
16. 2 100’ Woven Tapes
17. 3 Sets Staking Pins
18. 3 Sets Range Poles
19. 1 set Rhino Hand-held GPS receiver with 2-way communication
20. 3 sets Sokkia GPS sets

Soil Mechanics Lab (SCI 114) for Engr 430

The following equipment is in the lab

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave oven</td>
<td>Quick water content determination</td>
</tr>
<tr>
<td>Conventional oven</td>
<td>Water content determination</td>
</tr>
<tr>
<td>Triple beam balances</td>
<td>Soil weight</td>
</tr>
<tr>
<td>Compaction molds and hammers</td>
<td>Soil compaction characteristics</td>
</tr>
<tr>
<td>Sand cone density equipment</td>
<td>In situ density</td>
</tr>
<tr>
<td>Liquid limit device</td>
<td>Soil liquid limit</td>
</tr>
</tbody>
</table>

235
Plastic limit plates  Soil plastic limit
Sieves  Grain size determination, soil preparation
Sieve shaker  Grain size determination
Hydrometer  Grain size determination
Mortar and pestel  Soil preparation
Hydraulic jack and extruder  Soil extrusion
Consolidation equipment  Consolidation
Triaxial cell  Triaxial testing
Load frame  Loading
Pore pressure panel board  Pore pressure control and measurement
Fixed wall permeameter  Lab permeability
Miniature sealed double ring infiltrometer  Field permeability
Borehole permeameter  Field permeability
Guelph permeameter  Field permeability
Signal conditioner  Instrument reading
Dam flow model  Flow net, pore pressure, and permeability demonstration
Quicksand chamber  Quicksand demonstration
Retaining wall force model  Retaining wall rotation demonstration
Fault slippage model  Fault slippage demonstration
Landslide model  Landslide demonstration
Falling head permeameter  Permeability of coarse grained soils
Soils magic demonstration equipment  Illustrate soil concepts
Electronic scale  Weight of small samples
Direct shear device  Soil strength
Materials Testing and Metallurgy Laboratories (SCI 164) for Engr 200

The lab currently has the following equipment:
1. 1x Instron 3369 Tensile Test Machine (10000 lbs capacity, Windows 10 system)
2. 1x Tinius Olsen Compression Machine (60000 lbs capacity)
3. 3x Manual Rockwell Hardness Testers (Rockwell B and C scales)
4. 1x Brinell Hardness Tester (3000 kg capacity)
5. 1x Stereomicroscope (up to 800x)
6. 1x Charpy Impact Tester (up to 260 ft-lb capacity)
7. 2x Muffler Furnaces (up to 1100°C)
8. 4x Portable digital microscopes (to be checked out from Engineering stockroom)

While the number and varieties of equipment in this lab are adequate for undergraduate instruction, expansion and modernization of our current equipment base will be necessary to enhance students’ learning experience.

Fluids/Thermodynamics/Solids Laboratory (SCI 169) for Engr 302

The lab includes equipment for eight experimental laboratory assignments. These include beam bending, flow friction, centrifugal pump performance, Pelton Wheel (hydro-turbine) performance, diesel engine performance, Fourier analysis of vibrations, and bomb calorimetry. The lab is adequate for its intended purpose. One notable issue is that the fluid flow/pump apparatus is used for four separate experiments (laboratory assignments) which can only be run one at a time.

Engineering Experimentation Laboratory (SCI 111) for Engr 300

The lab is an integral part of ENGR 300, which also includes two lectures per week. Instrumentation includes transducers such as load cells, LVDTs, thermocouples, pressure transducers, and magnetic pickups with frequency to voltage converters for angular velocity movement. Traditional instruments are also used, including manometers, pressure gages, and Vernier and dial calipers.
Structural Laboratory for Multiple Hazard Mitigation (SCI 253) for Engr 699

The structural lab currently is located in SCI-253 and has a capacity of 10 students. The lab is established in 2010 by Professors Chen to serve research activities of his research group at San Francisco State University. Currently the lab provides space and computers to student researchers to conduct research in multi-hazard mitigation. A total of 9 desktop computers are available in SCI 253. The space and software in this lab are adequate for computationally intensive analysis. Upgrade of the computers and updates of the software will be necessary to enhance the lab capacity.

Advanced Material Research Lab (SCI 155) for Engr 699

The laboratory was formally established in 2009 for the purpose of materials science and engineering research. Initially, the laboratory contains four fume hoods, a large number of chemical glassware, a UV-VIS spectrophotometer, an Ozone reactor, and a centrifuge. New equipment and apparatus have continually been added to the laboratory as needed.

The laboratory currently houses the following equipment:
1. 1x 13.56 MHz, 600W RF generator with match network
2. 1x Agilent network analyzer
3. 1x probe station (donated by UC Berkeley's EECS department)
4. 1x 1000x light microscope
5. 1x VERSA STAT potentiostat
6. 1x 30kV high-tension supplier (currently on loan to Dept of Chemistry)
7. 1x minimill machine
8. 2x open-source 3D printers
9. 2x computer terminals
10. 1x 60W CO₂ laser cutter
11. 1x 40W CO₂ laser engraver

Multi-Media Computer Lab (SCI 146) for Engr 101 and 103

Currently, the laboratory has thirty workstations. The specifications of the thirty computers are listed in Table 1. All thirty computers share a common network HP 4100N Laser printer. Students are required to pay for printing using their student body card which has prepaid funds. The cost to the student is seven cents per page printed.
Table 1, Computer and Equipment Specifications

| 30- 2.4GHz PC’s w. 256 MB RAM w. 40 GB Hard Disk | One Overhead Projector: Panasonic Model PTL-780 NTU |
| 30-17.” Monitors | 1- HP 4100N Network Laser Printer |
| | 10/100 Base-T network CAT-5 wires |
| | Using 100 Base-T switches |

**Time Share Lab (SCI 143)**

Currently, this laboratory has 19 2.0Ghz dual core Dell PC workstations, each with 8GB of RAM, a 150 GB hard disk and 19” flat-screen monitors, and one 3.5Ghz Lenovo PC workstation with 10GB of RAM, a 450GB hard disk and 19” flat-screen monitor, which were last upgraded on October the 22nd of 2008. The lab’s computers are connected to the University network via high-speed wiring and switches. All the computers in this lab are also connected to the engineering LAN, with servers running the Windows operating systems. There is one HP laser printer for student use.
APPENDIX D - INSTITUTIONAL SUMMARY

Programs are requested to provide the following information.

1. **The Institution**
   a. Name and address of the institution
      
      San Francisco State University
      1600 Holloway Ave., San Francisco, CA 94132

   b. Name and title of the chief executive officer of the institution
      
      Leslie E. Wong, Ph.D.
      President, San Francisco State University

   c. Name and title of the person submitting the self-study report.
      
      Wenshen Pong, Ph.D., P.E.
      Director, School of Engineering
      Timothy D’Orazio, Ph.D., P.E.
      Head, Civil Engineering

   d. Name the organizations by which the institution is now accredited and the dates of the initial and most recent accreditation evaluations.
      
      University - Accrediting Commission for Senior Colleges and Universities of the Western Association of Schools and Colleges (WASC).
      
      Initial accreditation: 1949
      Most recent accreditation: 2013
      
      Engineering - Accreditation Board for Engineering and Technology
      
      Initial accreditation: 1972
      Most recent accreditation: 2012

Various specialized programs at the University are accredited by the following agencies.

<table>
<thead>
<tr>
<th>Program</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparel Design and Merchandising BS</td>
<td>American Association of Family and Consumer Sciences</td>
</tr>
<tr>
<td>Art BA/MA/MFA</td>
<td>National Association of Schools of Art and Design</td>
</tr>
<tr>
<td>Business Administration BS/MS/MBA</td>
<td>Association to Advance Collegiate Schools of Business</td>
</tr>
<tr>
<td>Chemistry BS</td>
<td>American Chemical Society</td>
</tr>
<tr>
<td>Cinema BA/MA/MFA</td>
<td>National Association of Schools of Art and Design</td>
</tr>
<tr>
<td>Civil Engineering BS</td>
<td>Accreditation Board for Engineering and Technology</td>
</tr>
<tr>
<td>Clinical Laboratory Science Graduate Internship Program</td>
<td>National Accrediting Agency for Clinical Laboratory Sciences</td>
</tr>
<tr>
<td>Program</td>
<td>Accrediting Organization</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Communicative Disorders MS</td>
<td>American Speech-Language-Hearing Association</td>
</tr>
<tr>
<td>Counseling MS</td>
<td>Council for Accreditation of Counseling and Related Educational Programs</td>
</tr>
<tr>
<td>Dietetics BS and Graduate Internship Program</td>
<td>Commission on Accreditation for Dietetics Education</td>
</tr>
<tr>
<td>Drama BA/MA</td>
<td>National Association of Schools of Theatre</td>
</tr>
<tr>
<td>Education MA</td>
<td>National Council for Accreditation of Teacher Education</td>
</tr>
<tr>
<td>Electrical Engineering BS</td>
<td>Accreditation Board for Engineering and Technology</td>
</tr>
<tr>
<td>Family and Consumer Sciences BA</td>
<td>American Association of Family and Consumer Sciences</td>
</tr>
<tr>
<td>Hospitality and Tourism Management BS</td>
<td>Association to Advance Collegiate Schools of Business</td>
</tr>
<tr>
<td>Interior Design BS</td>
<td>American Association of Family and Consumer Sciences</td>
</tr>
<tr>
<td>Journalism BA</td>
<td>Accreditation Council on Education in Journalism and Mass Communications</td>
</tr>
<tr>
<td>Mechanical Engineering BS</td>
<td>Accreditation Board for Engineering and Technology</td>
</tr>
<tr>
<td>Music BA/MA/BM/MM</td>
<td>National Association of Schools of Music</td>
</tr>
<tr>
<td>Nursing BS/MS</td>
<td>State Board of Registered Nursing Commission on Collegiate Nursing Education</td>
</tr>
<tr>
<td>Physical Therapy MS</td>
<td>Commission on Accreditation of Physical Therapy Education</td>
</tr>
<tr>
<td>Psychology, Concentration in Clinical Psychology MS</td>
<td>California State Board of Behavioral Sciences</td>
</tr>
<tr>
<td>Public Administration MPA</td>
<td>National Association of Schools of Public Affairs and Administration</td>
</tr>
<tr>
<td>Public Health MPA</td>
<td>Council on Education for Public Health</td>
</tr>
<tr>
<td>Recreation, Parks, and Tourism Administration BS</td>
<td>National Recreation and Park Association</td>
</tr>
<tr>
<td>Rehabilitation Counseling MS</td>
<td>Council on Rehabilitation Education</td>
</tr>
<tr>
<td>Social Work BA/MSW</td>
<td>Council on Social Work Education</td>
</tr>
<tr>
<td>Special Education MA and Concentration in PhD in Education</td>
<td>National Council for Accreditation of Teacher Education</td>
</tr>
<tr>
<td>Teacher Education Credential</td>
<td>California Commission on Teacher Credentialing</td>
</tr>
</tbody>
</table>
Programs

| Theatre Arts MFA: Concentration in Design and Technical Production | National Association of Schools of Theatre |

2. Type of Control

Description of the type of managerial control of the institution, e.g., private-non-profit, private-other, denominational, state, federal, public-other, etc.

San Francisco State University is a state supported public university in California and is one campus of the 23-campus California State University System.

3. Educational Unit

Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The chain of administrative commands is:

President: Leslie E. Wong
   Interim Provost and Vice President for Academic Affairs: Jennifer Summit
   Dean of College of Science and Engineering: Keith J. Bowman
   Director of School of Engineering: Wenshen Pong
   Program Head of Civil Engineering: Timothy D’Orazio
   Program Head of Computer Engineering: Thomas Holton
   Program Head of Electrical Engineering: Thomas Holton
   Program Head of Mechanical Engineering: A.S. Ed Cheng

4. Academic Support Units

List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

Math and Science
   Mathematics - Department Chair: David Bao
   Physics - Department Chair: Ron Marzke
   Chemistry - Department Chair: Jane DeWitt
   Computer Science - Department Chair: Bill Hsu

General Education
   English – Department Chair: Sugie Goen-Salter
   History – Department Chair: Trevor R. Getz
   Communication Studies (Speech) – Department Chair: Christina Sabee
   And many other departments in the university

5. Non-academic Support Units

List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

Library – University Librarian: Deborah Masters
Advising Center – Kim Altura, Director
Career Center – Shimina Harris, Director
Division of Information Technology (computer labs and support, network, infrastructure, email, etc.) – Nish Malik, Associate Vice President and CTO of Information Technology
Academic Technology (AV support, online instructional support, etc.) – Maggie Beers, Director
Learning Assistance Center (LAC) – Deborah vanDommelen, Director
Campus Academic Resource Program (CARP) – Morris Head, Senior Coordinator
College of Science and Engineering Student Resource Center – Nilgun Ozer, Director
Center for Science and Mathematics Education – Eric Hsu, Director
MESA Engineering Program – Nilgun Ozer, Director

6. Credit Unit
It is assumed that one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

One credit is one lecture hour or three laboratory hours per week. One academic year is composed of two semesters with 15 weeks of instruction, exclusive of final examination week, per semester. Summer sessions are shorter than 15 weeks but weekly lecture/laboratory hours are increased so that the total number of instructional hours is the same as that of regular semesters. Civil engineering program requires 127 semester credits for graduation.

7. Tables
Complete the following tables for the program undergoing evaluation.
Table D-1. Program Enrollment and Degree Data

Civil Engineering

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Enrollment Year</th>
<th>Total Grad</th>
<th>Degrees Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st 2nd 3rd 4th 5th</td>
<td></td>
<td>Associates</td>
</tr>
<tr>
<td>Current Year</td>
<td>FT 54 27 37 70 85</td>
<td>273</td>
<td>3 (Summer)</td>
</tr>
<tr>
<td></td>
<td>PT 5 1 8 12 23</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FT 51 35 50 68 98</td>
<td>302</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PT 8 3 4 14 15</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FT 59 22 35 53 106</td>
<td>275</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PT 1 1 5 9 11</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FT 52 28 42 48 129</td>
<td>299</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PT 1 4 1 15 19</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>FT 51 18 39 71 111</td>
<td>290</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PT 0 1 1 13 17</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

Give official fall term enrollment figures (head count) for the current and preceding four academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the fall visit.

FT--full time
PT--part time
Table D-2. Personnel

School of Engineering
Civil Engineering
Year¹: Fall 2016

<table>
<thead>
<tr>
<th></th>
<th>HEAD COUNT</th>
<th></th>
<th>FTE²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FT</td>
<td>PT</td>
<td></td>
</tr>
<tr>
<td>Administrative²</td>
<td>1</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Faculty (tenure-track)³</td>
<td>6</td>
<td></td>
<td>6.0</td>
</tr>
<tr>
<td>Other Faculty (excluding student Assistants)⁵</td>
<td>8</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>Student Teaching Assistants⁴</td>
<td>3</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Technicians/Specialists</td>
<td>2</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Office/Clerical Employees</td>
<td>1</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Others⁵ (Student Assistants)</td>
<td>6</td>
<td></td>
<td>2.25</td>
</tr>
</tbody>
</table>

Report data for the program being evaluated.

1. Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.

2. Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.

3. For faculty members, 1 FTE equals what your institution defines as a full-time load.

4. For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc. For faculty members, 1 FTE equals what your institution defines as a full-time load.

5. Specify any other category considered appropriate, or leave blank.

6. Faculty head count is program specific while everything else is shared by School of Engineering.
APPENDIX E
ADDITIONAL SUPPORTING INFORMATION

1. Prerequisite waiver form
2. Engineering graduation application form
3. General Education (GE) graduation worksheet
4. Civil Engineering Student planning worksheet
5. Alumni survey
6. Sample course-based-assessment (CBA) sheets
7. Senior exit survey
8. Civil Engineering program information sheet
9. Academic probation contract
PETITION FOR PREREQUISITE EXCEPTION OR WAIVER

School of Engineering
San Francisco State University

Student Name: _________________________________________________________________
(last, first, middle initial)

Major: _________________________ Student Status: ________________________________
(freshman, sophomore, junior, senior)

Student Number: _______________________________________________________________

Course Number: _______________________________________________________________

Prerequisite(s) to be waived:_______________________________________________________

Name of Instructor approving waiver of prerequisite(s):_______________________________

Instructor’s justification for waiver:

________________________________________________________________________
Instructor’s Signature of approval: ________________________________

_________________________________________________________________________
School Director’s signature of approval: ________________________________

San Francisco State University
School of Engineering
# Engineering BS Degree

## Graduation Documentation Coversheet and Checklist

<table>
<thead>
<tr>
<th>Name: _____________________________</th>
<th>Student ID: ______________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFSU Email: _________________</td>
<td>Personal Email: ______________________</td>
</tr>
<tr>
<td>Mailing Address: ____________________________</td>
<td></td>
</tr>
<tr>
<td>Major:  □ Civil  □ Computer  □ Electrical  □ Mechanical</td>
<td></td>
</tr>
<tr>
<td>Pattern:  □ Native  □ Transfer</td>
<td></td>
</tr>
</tbody>
</table>

- Make sure each appropriate item is completed and checked off.
- Submit this coversheet with your graduation application

- [ ] University Baccalaureate Application Form

  - [ ] Obtain online at [http://www.sfsu.edu/~admisrec/reg/ga.htm](http://www.sfsu.edu/~admisrec/reg/ga.htm) after you complete the exit survey.
  - [ ] Do not fill in an “Emphasis” after the “Major.”
  - [ ] List courses in ascending order.
  - [ ] List only upper division (**ENGR 300 and above**) courses for major.

  - → Exception: If you are still taking lower division courses in your major at SFSU or a community college, list these courses too.

  - [ ] If you have transfer credit for any upper division SFSU course, use the course number and title from the institution where you took it.

  - [ ] Where the application form asks for the name of your advisor, enter the name of the Program Head for your major for Spring 2017. They are as follows:

    - **Civil Engineering**  - Dr. T. D’Orazio
    - **Computer Engineering**  - Dr. Tom Holton
    - **Electrical Engineering**  - Dr. Tom Holton
☐ **Engineering Student Planning Worksheet**

☐ Complete your worksheet with grades and semester. If it is messy, redo it

☐ For transfer students, the back of the worksheet must be filled in and signed, or a copy of same from your old worksheet should be attached.

☐ **Degree Progress Report (DPR)**

☐ Make sure you have a current DPR, not an old one. Note you will need a second copy of your DPR for your GE application

☐ Highlight all courses required for your engineering curriculum, both lower and upper division courses.
Engineering GE Application for Graduation Purpose

Documentation Coversheet and Checklist

This form applies only to students who were admitted before Fall 2014.

Students admitted in/after Fall 2014 need not submit GE application.

Name:___________________________________ Student ID:_________________

SFSU Email: _______________ Personal Email : ______________ Phone# : ____________

Mailing Address: __________________________________________________________

Major: □ Civil   □ Computer   □ Electrical   □ Mechanical

Pattern: □ Native    □ Transfer

- Make sure each appropriate item is completed and checked off.
- Submit this coversheet with your G.E. documentation

☐ G.E. Graduation Application Form

Download and complete a GE Worksheet from below. Fill it out and submit with this coversheet. Please TYPE and not hand-write.

- For Transfer Student, use:
  http://engineering.sfsu.edu/current_students/eforms_download/pdfs/ge_worksheet_transfer.pdf
- For Native Student, use:
  http://engineering.sfsu.edu/current_students/eforms_download/pdfs/ge_worksheet_native.pdf

☐ Degree Progress Report (DPR) and DARS (if available)
Submit the latest DPR and DARS (if available) with this form.

☐ Previously reviewed G.E. Worksheet (if applicable)

Attach a GE worksheet that was previously reviewed and commented on by a GE advisor.

☐ Copies of all G.E. Petitions filed (if applicable)

☐ Advanced Standing Evaluation (ASE) Form (if available)

Only applicable to students who have completed GE courses at a non-DPRS school, including out-of-state colleges and foreign universities.
This worksheet centralizes information pertaining to your progress towards graduation, including contact information, course planning, and transfers. You should keep an updated copy of this worksheet in your folder in the engineering office. Privacy note: By law, all student information and grades are kept strictly confidential and are only accessed by authorized personnel of the School of Engineering.

Student Information

Student ID

\[
\begin{array}{cccccc}
\hline
\text{Student ID} & \text{#:} & \text{Male} & \text{Female} \\
\hline
\end{array}
\]

Name:

LAST \hspace{2cm} FIRST \hspace{2cm} MI

Main address to which official mail may be sent:

________________________________________________________

STREET

________________________________________________________

CITY

__________________________  ______________

STATE      ZIP

(______)______________________ ______________________________________

PHONE      E-MAIL

Alternate address (i.e. work/parents):

________________________________________________________

STREET

________________________________________________________

CITY

252
STATE  ZIP

(_____)____________________

PHONE  E-MAIL

Term/Year entered SFSU: ____________________  Term/Year you expect to graduate: ____________________

☐ Transfer Student?  ☐ If yes, are your transfer credits evaluated?

☐ Graduation plan O.K.?

Advising Information

<table>
<thead>
<tr>
<th>Advisor Name</th>
<th>Approval Signature</th>
<th>Term</th>
<th>Year</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Required Courses
- 15 units of required mathematics, 12 units of physics, and 3 units of chemistry.
- 18 units of required lower division engineering courses and 31 units of required upper division courses
- 12 units of engineering elective courses, and 36 units of General Education courses
- Course prerequisites are strictly enforced. Students not meeting the prerequisites are subject to being administratively dropped.

**Required Math and Science Lower Division Courses**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Units</th>
<th>Grade</th>
<th>SFSU or Transfer</th>
<th>Term Yr</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 180</td>
<td>Chemistry for the Energy and the Environment</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>550 or above on Entry Level Math (ELM) exam or approved exemption, or MATH 70© and satisfactory score on chemistry placement exam.</td>
</tr>
<tr>
<td>MATH 226</td>
<td>Calculus I</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>Successful completion of ELM requirement; MATH 199© or equivalent.</td>
</tr>
<tr>
<td>MATH 227</td>
<td>Calculus II</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>MATH 226©</td>
</tr>
<tr>
<td>MATH 228</td>
<td>Calculus III</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>MATH 227©</td>
</tr>
<tr>
<td>MATH 245</td>
<td>Elementary Differential Equations &amp; Linear Algebra</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>MATH 228©</td>
</tr>
<tr>
<td>PHYS 220/222</td>
<td>General Physics with Calculus I &amp; Lab</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>High school physics or equivalent; MATH 226©; PHYS 222♥; MATH 227♥</td>
</tr>
<tr>
<td>PHYS 230/232</td>
<td>General Physics with Calculus II &amp; Lab</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>PHYS 220© and MATH 227©; PHYS 232♥</td>
</tr>
<tr>
<td>PHYS 240/242</td>
<td>General Physics with Calculus III &amp; Lab</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>PHYS 220© and MATH 227©; PHYS 242♥</td>
</tr>
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</table>

**Required Lower Division Courses for Civil Engineering**
<table>
<thead>
<tr>
<th>ENGR</th>
<th>Course Name</th>
<th>Units</th>
<th>Grade</th>
<th>SFSU or Transfer</th>
<th>Term Yr</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>Engineering Experimentation</td>
<td>3</td>
<td>F,S</td>
<td></td>
<td>F,S</td>
<td>ENGR 200, 205; English 214 ©</td>
</tr>
<tr>
<td>302</td>
<td>Experimental Analysis</td>
<td>1</td>
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<td>ENGR 300, 304♥, 309</td>
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<tr>
<td>304</td>
<td>Mechanics of Fluids</td>
<td>3</td>
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<tr>
<td>309</td>
<td>Mechanics of Solids</td>
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<td>ENGR 102, 200♥</td>
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<tr>
<td>323</td>
<td>Structural Analysis**</td>
<td>3</td>
<td>S</td>
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<td>ENGR 309</td>
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<tr>
<td>425</td>
<td>Reinforced Concrete Structures</td>
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<td>F,S</td>
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<td>ENGR 323♥</td>
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<tr>
<td>429</td>
<td>Construction Management**</td>
<td>3</td>
<td>S</td>
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<td>S</td>
<td>ENGR 235</td>
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<tr>
<td>430</td>
<td>Soil Mechanics**</td>
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<td>S</td>
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<td>S</td>
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<tr>
<td>434</td>
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<td>3</td>
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<td>ENGR 304♥, CHEM 180 or CHEM 115</td>
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<td>436</td>
<td>Transportation Engineering**</td>
<td>3</td>
<td>S</td>
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<td>S</td>
<td>ENGR 235, ENGR 430♥</td>
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<tr>
<td>696</td>
<td>Engineering Design Project I*</td>
<td>1</td>
<td>F,S</td>
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<td>F,S</td>
<td>Complete 21 upper division engineering units; ENGR 302;</td>
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<tr>
<td>697</td>
<td>Engineering Design Project II**</td>
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<td>ENGR 696</td>
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</tbody>
</table>

♥ = Course must either be completed or taken concurrently
© = Course must have been passed with a grade of C or better
* = Course offered in fall semester only
** = Course offered in spring semester only
Elective Courses

- 12 upper division engineering elective units are required.
- Upper division courses must have been taken within 10 years of graduation.
- The courses selected should conform to focus area (Construction management, Geotechnical, Structural, or Environmental Engineering) curriculum recommendations.

Elective Upper Division Courses for Civil Engineering
<table>
<thead>
<tr>
<th>ENGR</th>
<th>Course Name</th>
<th>Units</th>
<th>Grad e</th>
<th>SFSU or Transfer</th>
<th>Year Taken</th>
<th>Semester Offered</th>
<th>Prerequisite</th>
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<tbody>
<tr>
<td>303</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
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<td>F,S</td>
<td>PHYS 240</td>
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<tr>
<td>426</td>
<td>Steel Structures</td>
<td>3</td>
<td>0</td>
<td>3</td>
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<td>S</td>
<td>ENGR 323</td>
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<tr>
<td>427</td>
<td>Wood Structures</td>
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<td>3</td>
<td></td>
<td>F</td>
<td>ENGR 323</td>
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<td>Foundation Engineering</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td></td>
<td>F</td>
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<tr>
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<td>Environmental Engineering Design</td>
<td>3</td>
<td>1</td>
<td>2</td>
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<td>S</td>
<td>CHEM 115 or CHEM 180</td>
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<tr>
<td>439</td>
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<td>3</td>
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<td>1.5</td>
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<td>F</td>
<td>ENGR 309, 430 &amp; Math 227</td>
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<tr>
<td>441</td>
<td>Fundamentals of Composite Materials</td>
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<td>1</td>
<td>2</td>
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<td>S</td>
<td>ENGR 309, Math 245</td>
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<td>3</td>
<td>2.5</td>
<td>0.5</td>
<td></td>
<td>F</td>
<td>ENGR 201, 309, MATH 245</td>
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<td>3</td>
<td>2</td>
<td>1</td>
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<td>S</td>
<td>ENGR 304</td>
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<tr>
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<td>Renewable Energy Systems</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td>F</td>
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<td></td>
<td></td>
<td>F,S</td>
<td></td>
<td>ENGR 103 or ENGR 213 &amp; Math 227</td>
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<tr>
<td>823</td>
<td>Introduction to Seismology</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
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<td>Check schedule for course availability</td>
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<tr>
<td>825</td>
<td>Bridge Engineering and Prestressed RC</td>
<td>3</td>
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<td>ENGR 425 &amp; Graduate Standing</td>
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<td>2</td>
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<td>ENGR 425 or 426 and graduate standing</td>
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<td>Structural Design for Fire Safety</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td></td>
<td>ENGR 323; ENGR 425 or ENGR 426</td>
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<td>Base Isolation</td>
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<td>0</td>
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<tr>
<td>829</td>
<td>Advanced Topics in Structural Engineering</td>
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<td>0</td>
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<td>ENGR 323, 461</td>
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<td>2</td>
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<td>832</td>
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<td>2</td>
<td>1</td>
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<td>ENGR 425, 426, 461</td>
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<tr>
<td>833</td>
<td>Principles of Earthquake Engineering</td>
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<td>1</td>
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<td>ENGR 461</td>
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<table>
<thead>
<tr>
<th>Units Completed</th>
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<tbody>
<tr>
<td></td>
<td>12</td>
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<tr>
<td>Term</td>
<td>Year</td>
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<td>------</td>
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<td></td>
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</tr>
</tbody>
</table>
Transferred Courses

Students wishing to transfer Math, Science and Engineering courses from other institutions must see the Program Head of Civil Engineering in their first term of residence at SFSU. If you haven’t yet done your transfer credit evaluation with the Program Head, you may not be able to enroll for courses, so do it now! Students transferring from California institutions just need to bring in their transcripts and this worksheet. Transfers of courses from other institutions are evaluated on a case-by-case basis. Students from these institutions should bring all relevant supporting material, including course syllabi, books, etc.

Name: ___________________________________________ ID # ____________________________
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Institution</th>
<th>Course</th>
<th>Units†</th>
<th>Term/Year</th>
<th>Grade</th>
<th>Approval</th>
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<tbody>
<tr>
<td>CHEM 115 or CHEM 180</td>
<td>General Chemistry I: Essential Concepts of Chemistry</td>
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<tr>
<td>MATH 226</td>
<td>Calculus I</td>
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<td></td>
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<tr>
<td>MATH 227</td>
<td>Calculus II</td>
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<td>MATH 228</td>
<td>Calculus III</td>
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<tr>
<td>MATH 245</td>
<td>Elementary Differential Equations &amp; Linear Algebra</td>
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<tr>
<td>PHYS 220/222</td>
<td>General Physics with Calculus I &amp; Lab</td>
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<tr>
<td>PHYS 230/232</td>
<td>General Physics with Calculus II &amp; Lab</td>
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<tr>
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<tr>
<td>ENGR 103</td>
<td>Introduction to Computers</td>
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<tr>
<td>ENGR 201</td>
<td>Dynamics</td>
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<tr>
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<tr>
<td>ENGR 235</td>
<td>Surveying</td>
<td></td>
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</tr>
</tbody>
</table>
† Express as semester units. Each quarter unit = 2/3 semester units

Examined by: ___________________________ Signed: ___________________________ Date: ______________

May 30, 2017
Course:  ENGR 304
Instructor:  Tan

Summary of outcomes, performance criteria and metrics
We are using this course to assess the following student outcome:

- (e):  Ability to identify, formulate, and solve engineering problems.

We have identified the following performance criteria that can be used to assess these outcomes.  These criteria are listed below along with the metric to be used.

<table>
<thead>
<tr>
<th>No.</th>
<th>Outcome</th>
<th>Performance Criterion</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(e)</td>
<td>Student is able to correctly apply the equations of hydrostatics to solve problems related to hydrostatic pressure variation and buoyancy.</td>
<td>Selected HW or exam problem(s)</td>
</tr>
<tr>
<td>2</td>
<td>(e)</td>
<td>Student is able to correctly use the Bernoulli Equation solve for the pressure and/or velocity at a point in a flow field.</td>
<td>Selected HW or exam problem(s)</td>
</tr>
<tr>
<td>3</td>
<td>(e)</td>
<td>Student has an understanding of the momentum equation and can apply it correctly to solve fluid flow problems.</td>
<td>Selected HW or exam problem(s)</td>
</tr>
<tr>
<td>4</td>
<td>(e)</td>
<td>Student is able to formulate and solve problems using dimensional analysis.</td>
<td>Selected HW or exam problem(s)</td>
</tr>
</tbody>
</table>

There is one type of metric to be used in this course.  General instructions for data collection, analysis and reporting are provided on the next page.
General instructions for data collection, analysis and reporting

There are two parts to the assessment process for this course: data collection and analysis, and preparation of the course assessment report.

Data collection and analysis
In this course, there is one type of metric for which data needs to be collected:

Selected HW or Exam Problems

- Instructor selects problems from homework or exams that correspond to given performance criteria.
- Instructor tabulates average student scores on these problems on Data Collection and Reporting Form.

We ask you to collect and analyze data for each of these metrics. To make your job easier, we have prepared a page for each metric. The Data Collection Instructions and Reporting Form provides instructions on how to collect the appropriate data and analyze it. The first page also provides a place for reporting the results and requests comments if results fail the acceptance criterion.

Preparation of the course assessment report.
When you have finished the collection and analysis process, you will need to prepare an Assessment Report consisting of the following:

- Course Syllabus
- Data Collection Instruction and Reporting Forms, with Data Collection Forms attached.
- Please note that the forms request that you attach comments if the metric fails to meet the acceptance criterion. Please comment on why you feel it failed and what modification to the course content and/or instructional methods might improve student performance.
Selected HW or Exam Problems

Data Collection Instructions and Reporting Form

Purpose

This metric is used to assess the following performance criteria:

1. Student is able to correctly apply the equations of hydrostatics to solve problems related to hydrostatic pressure variation and buoyancy. [Outcome (e)]
2. Student is able to correctly use the Bernoulli Equation solve for the pressure and/or velocity at a point in a flow field. [Outcome (e)]
3. Student has an understanding of the momentum equation and can apply it correctly to solve fluid flow problems. [Outcome (e)]
4. Student is able to formulate and solve problems using dimensional analysis. [Outcome (e)]

Instructions for data collection

This page gives a form for assessing the overall performance of the class on each of the performance criteria. The instructor should choose five problems from homework or exams, one problem corresponding to each of the performance criteria.

Reporting

- For each selected problem, fill in the HW or exam and problem number (e.g. 2.3).
- Attach copy of problem statements.
- For each selected problem, tabulate the average score (normalized to 100%), std. dev and number of students and report it here:

<table>
<thead>
<tr>
<th>Performance Criterion</th>
<th>HW/Exam</th>
<th>Average Score (0-100%)</th>
<th>Std. Dev (%)</th>
<th>Number of students</th>
<th>Acceptance Criteria (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HW3</td>
<td>86.7</td>
<td>3.6</td>
<td>27</td>
<td>70</td>
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<tr>
<td>2</td>
<td>HW4</td>
<td>88.9</td>
<td>11.6*</td>
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<td>70</td>
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<tr>
<td>3</td>
<td>HW6</td>
<td>85.8</td>
<td>17.0*</td>
<td>27</td>
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<tr>
<td>4</td>
<td>HW8</td>
<td>83.6</td>
<td>12.3*</td>
<td>27</td>
<td>70</td>
</tr>
</tbody>
</table>

* NOTE: high standard deviation due to one or more zero scores

- If the average score of a given problem is below the acceptance criterion, the instructor should append a short paragraph commenting on why the criterion was not met and what modification to the course content and/or instructional methods might improve student performance.
HW3: textbook problems 3.62, 3.64, 3.86, and 3.90.

3.62 The gate shown is rectangular and has dimensions height \( h = 6 \) m by width \( b = 4 \) m. The hinge is \( d = 3 \) m below the water surface. What is the force at point \( A \)? Neglect the weight of the gate.

![Problem 3.62](image)

3.64 The square gate shown is eccentrically pivoted so that it automatically opens at a certain value of \( h \). What is that value in terms of \( \ell \)?

![Problem 3.64](image)
3.86 Determine the minimum volume of concrete ($\gamma = 23.6$ kN/m$^3$) needed to keep the gate (1 m wide) in a closed position, with $\ell = 3$ m. Note the hinge at the bottom of the gate.

![Diagram of a gate with a submerged concrete block and water.]  

**Problem 3.86**

3.90 The hydrometer shown weighs 0.015 N. If the stem sinks 7.2 cm in oil ($z = 7.2$ cm), what is the specific gravity of the oil?

![Diagram of a hydrometer partially submerged in oil.]  

**Problems 3.90, 3.91**
HW4: textbook problems 4.24, 4.38, 4.40, 4.70, 4.78, and 4.88.

4.24 Tests on a sphere are conducted in a wind tunnel at an air speed of $U_0$. The velocity of flow toward the sphere along the longitudinal axis is found to be $u = -U_0 (1 - r_0^2/x^2)$, where $r_0$ is the radius of the sphere and $x$ the distance from its center. Determine the acceleration of an air particle on the $x$-axis upstream of the sphere in terms of $x$, $r_0$, and $U_0$.

![Problem 4.24 Diagram](image)

4.38 If the velocity varies linearly with distance through this water nozzle, what is the pressure gradient, $dp/dx$, halfway through the nozzle? Assume $\rho = 62.4 \text{ lbm/ft}^3$.

![Problem 4.38 Diagram](image)

4.40 The closed tank shown, which is full of liquid, is accelerated downward at $\frac{2}{3}g$ and to the right at $1g$. Here $L = 2.5 \text{ m}$, $H = 3 \text{ m}$, and the liquid has a specific gravity of 1.3. Determine $p_C - p_A$ and $p_B - p_A$.

![Problem 4.39, 4.40 Diagram](image)
4.78 Ideal flow theory will yield a flow pattern past an airfoil similar to that shown. If the approach air velocity $V_0$ is 80 m/s, what is the pressure difference between the bottom and the top of this airfoil at points where the velocities are $V_1 = 85$ m/s and $V_2 = 75$ m/s? Assume $\rho_{\text{air}}$ is uniform at 1.2 kg/m$^3$.

![Problem 4.78](image)

4.88 A U-tube is rotated about one leg, as shown. Before being rotated the liquid in the tube fills 0.25 m of each leg. The length of the base of the U-tube is 0.5 m, and each leg is 0.5 m long. What would be the maximum rotation rate (in rad/s) to ensure that no liquid is expelled from the outer leg?

![Problem 4.88](image)

6.12 This tank provides a water jet (70°F) to cool a vertical metal surface during manufacturing. Calculate $V$ when a horizontal force of 180 lbf is required to hold the metal surface in place. $Q = 3$ cfs.

![Diagram of water jet](image1)

Problems 6.12, 6.13

6.26 A water jet with a speed of 60 ft/s and a mass flow rate of 40 lbm/s is turned 30° by a fixed vane. Find the force of the water jet on the vane. Neglect gravity.

![Diagram of water jet turned by vane](image2)

Problem 6.26

6.40 Water at 60°F flows through a nozzle that contracts from a diameter of 12 in. to 1 in. The pressure at section 1 is 2500 psig, and atmospheric pressure prevails at the exit of the jet. Calculate the speed of the flow at the nozzle exit and the force required to hold the nozzle stationary. Neglect weight.
6.62 This nozzle bends the flow from vertically upward to 30° with the horizontal and discharges water (γ = 62.4 lbf/ft³) at a speed of \( V = 130 \) ft/s. The volume within the nozzle itself is 1.8 ft³, and the weight of the nozzle is 100 lbf. For these conditions, what vertical force must be applied to the nozzle at the flange to hold it in place?

6.74 For laminar flow in a pipe, wall shear stress (\( \tau_0 \)) causes the velocity distribution to change from uniform to parabolic as shown. At the fully developed section (section 2), the velocity profile is \( u = u_{\text{max}}[1 - (r/r_0)^2] \). Derive a formula for the force on the wall due to shear stress, \( F_\tau \), between 1 and 2 as a function of \( U \) (the mean velocity in the pipe), \( \rho \), \( p_1 \), \( p_2 \), and \( D \) (the pipe diameter).
6.92 A centrifugal fan is used to pump air. The fan rotor is 1 ft in diameter, and the blade spacing is 2 in. The air enters with no angular momentum and exits radially with respect to the fan rotor. The discharge is 1500 cfm. The rotor spins at 3600 rev/min. The air is at atmospheric pressure and a temperature of 60°F. Neglect the compressibility of the air. Calculate the power (hp) required to operate the fan.
HW 8: textbook problems 8.4, 8.40, 8.42, and 8.60.

**8.4** Determine which of the following equations are dimensionally homogeneous:

- **a.** \( Q = \frac{2}{3} CL \sqrt{2gH^{3/2}} \)

  where \( Q \) is discharge, \( C \) is a pure number, \( L \) is length, \( g \) is acceleration due to gravity, and \( H \) is head.

- **b.** \( V = \frac{1.49}{n} R^{2/3} S^{1/2} \)

  where \( V \) is velocity, \( n \) is length to the one-sixth power, \( R \) is length, and \( S \) is slope.

- **c.** \( h_f = \frac{f}{D} \frac{L}{2g} V^2 \)

  where \( h_f \) is head loss, \( f \) is a dimensionless resistance coefficient, \( L \) is length, \( D \) is diameter, \( V \) is velocity, and \( g \) is acceleration due to gravity.

- **d.** \( D = \frac{0.074 B x p V^2}{Re^{0.2}} \)

  where \( D \) is drag force, \( Re \) is \( V x / \nu \), \( B \) is width, \( x \) is length, \( p \) is mass density, \( \nu \) is the kinematic viscosity, and \( V \) is velocity.

**8.40** Flow in a given pipe is to be tested with air and then with water. Assume that the velocities (\( V_A \) and \( V_W \)) are such that the flow with air is dynamically similar to the flow with water. Then for this condition, the magnitude of the ratio of the velocities, \( V_A / V_W \), will be (a) less than unity, (b) equal to unity, or (c) greater than unity.
8.42 A student is competing in a contest to design a radio-controlled blimp. The drag force acting on the blimp depends on the Reynolds number, \( \text{Re} = \frac{(\rho V D)}{\mu} \), where \( V \) is the speed of the blimp, \( D \) is the maximum diameter, \( \rho \) is the density of air, and \( \mu \) is the viscosity of air. This blimp has a coefficient of drag \((C_D)\) of 0.3. This \( \tau \)-group is defined as

\[
C_D = 2 \frac{F_D}{\rho V^2 A_p}
\]

where \( F_D \) is the drag force, \( \rho \) is the density of ambient air, \( V \) is the speed of the blimp, and \( A_p = \pi D^2/4 \) is the maximum section area of the blimp from a front view. Calculate the Reynolds number, the drag force in newtons, and the power in watts required to move the blimp through the air. Blimp speed is 800 mm/s, and the maximum diameter is 475 mm. Assume that ambient air is at 20°C.

![Problem 8.42](image)

8.60 A 1/25-scale model of a spillway is tested. The discharge in the model is 0.1 m³/s. To what prototype discharge does this correspond? If it takes 1 min for a particle to float from one point to another in the model, how long would it take a similar particle to traverse the corresponding path in the prototype?
This assessment report contains the following:

- Cover Sheet (this page)
- Course Syllabus
- Data Collection Instruction and Reporting Forms, with Data Collection Forms attached
- Homework and Exam Statements

We are using this course to assess the following student outcomes:

- (c): Ability to analyze and design systems, components or processes relevant to their field of specialty (Crit. 3.c)

We have identified the following performance criteria that can be used to assess these outcomes. These criteria are listed below along with the metric to be used.

<table>
<thead>
<tr>
<th>No.</th>
<th>Outcome</th>
<th>Performance Criterion</th>
<th>Metric</th>
</tr>
</thead>
</table>
| 1   | (c)     | Student is able to design reinforced concrete structural components, such as beams, columns, and slabs. | 1. Selected homework problems  
2. Selected exam problems |
| 2   | (c)     | Student is able to verify if optimal design has been achieved based on strength and serviceability requirements. | 1. Selected homework problems  
2. Selected exam problems |

There are two (2) metrics to be used in this course. From the materials provided in this assessment report (listed above), the metrics meet the acceptance criterion.
Summary of outcomes, performance criteria and metrics

We are using this course to assess the following student outcomes:

- (c): Ability to analyze and design systems, components or processes relevant to their field of specialty (Crit. 3.c)

We have identified the following performance criteria that can be used to assess these outcomes. These criteria are listed below along with the metric to be used.

<table>
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</thead>
</table>
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2. Selected exam problems |
| 2   | (c)     | Student is able to verify if optimal design has been achieved based on strength and serviceability requirements. | 1. Selected homework problems  
2. Selected exam problems |

There are two (2) metrics to be used in this course. General instructions for data collection, analysis and reporting are provided on the next page.
General instructions for data collection, analysis and reporting

There are two parts to the assessment process for this course: **data collection and analysis**, and **preparation of the course assessment report**.

**Data collection and analysis**

In this course, there are **two metrics** for which data needs to be collected:

1. **Selected Homework Problems**
   - Instructor selects homework problems from assignments that correspond to given performance criteria.
   - Instructor tabulates average student scores on these problems on Data Collection and Reporting Form.

2. **Selected Exam Problems**
   - Instructor selects problems from exams that correspond to given performance criteria.
   - Instructor tabulates average student scores on these problems on Data Collection and Reporting Form.

We ask you to collect and analyze data for each of these metrics. To make your job easier, we have prepared a page for each metric:

- The **Data Collection Instructions and Reporting Form** provides instructions on how to collect the appropriate data and analyze it. The first page also provides a place for reporting the results and requests comments if results fail the acceptance criterion.

**Preparation of the course assessment report.**

When you have finished the collection and analysis process, you will need to prepare an Assessment Report consisting of the following:

- Cover sheet
- Course Syllabus
- Data Collection Instruction and Reporting Forms, with Data Collection Forms attached.
- Please note that the forms request that you to attach comments if the metric fails to meet the acceptance criterion. Please comment on why you feel it failed and what modification to the course content and/or instructional methods might improve student performance.
Selected Homework Problems
Data Collection Instructions and Reporting Form

Purpose
This metric is used to assess the following performance criteria
1. Student is able to design reinforced concrete structural components, such as beams, columns, and slabs. (Outcome (c))
2. Student is able to verify if optimal design has been achieved based on strength and serviceability requirements. (Outcome (c))

Instructions for data collection
This page gives a form for assessing the overall performance of the class on each of the performance criteria.

The instructor should choose one or more problems from homework sets, corresponding to each of the performance criteria.

Reporting
- For each selected problem, fill in the homework and problem number (e.g. 2.3).
- Attach copy of problem statements.
- For each selected problem, tabulate the average score (normalized to 100%), std. dev and number of students and report it here:

<table>
<thead>
<tr>
<th>Performance Criterion</th>
<th>Homework / Problem Number</th>
<th>Average Score (0-100%)</th>
<th>Std. Dev (%)</th>
<th>Number of students</th>
<th>Acceptance Criteria (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HW5/Q3</td>
<td>86%</td>
<td>35%</td>
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<tr>
<td>2</td>
<td>HW4/Q1</td>
<td>92%</td>
<td>28%</td>
<td>36</td>
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</table>

- If the average score of a given problem is below the acceptance criterion, the instructor should append a short paragraph commenting on why the criterion was not met and what modification to the course content and/or instructional methods might improve student performance.
Selected Exam Problems
Data Collection Instructions and Reporting Form

Purpose
This metric is used to assess the following performance criteria
1. Student is able to design reinforced concrete structural components, such as beams, columns, and slabs. (Outcome (c))
2. Student is able to verify if optimal design has been achieved based on strength and serviceability requirements. (Outcome (c))

Instructions for data collection
This page gives a form for assessing the overall performance of the class on each of the performance criteria.

The instructor should choose two problems from exams, one problem corresponding to each of the performance criteria.

Reporting
- For each selected problem, fill in the exam and problem number (e.g. 2.3).
- Attach copy of problem statements.
- For each selected problem, tabulate the average score (normalized to 100%), std. dev and number of students and report it here:

<table>
<thead>
<tr>
<th>Performance Criterion</th>
<th>Exam / Problem Number</th>
<th>Average Score (0-100%)</th>
<th>Std. Dev (%)</th>
<th>Number of students</th>
<th>Acceptance Criteria (%)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Exam/Q1</td>
<td>83</td>
<td>10</td>
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<td>Exam/Q2</td>
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<td>10</td>
<td>36</td>
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</tbody>
</table>

- If the average score of a given problem is below the acceptance criterion, the instructor should append a short paragraph commenting on why the criterion was not met and what modification to the course content and/or instructional methods might improve student performance.
## ENGR 425: Data Collection Forms

<table>
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<th>Student</th>
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<tr>
<td>36</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>90</td>
</tr>
</tbody>
</table>

| Average | 86 | 92 | 83 | 79 |
| Std. Dev | 35 | 28 | 10 | 10 |
Thank you for taking the time to provide us with feedback about your experience as an Engineering major at SFSU. Your feedback is very important to us. Your responses will remain anonymous.

Current semester (e.g., Spring 2017) ____________________________
Semester first enrolled at SFSU ____________________________

Background questions. Please respond to all questions that apply.

1. Major: Civil Computer Electrical Mechanical
2. I am a member of student professional societies: (circle all that apply)
   ASCE ASME IEEE NSBE SHPE SWE ISA ASHRAE SME SAE
3. I participated in professional society competition(s) for: (circle all that apply)
   ASCE ASME IEEE NSBE SHPE SWE ISA ASHRAE SME SAE
   Name(s) of competition(s) ______________________________________________________
4. Average number of hours per week of paid employment while you were a student. _____________
5. Approximate overall GPA at SFSU ______________
6. Approximate high school GPA ______________
7. Math SAT score ______________
8. Verbal SAT score ______________
9. Math ACT score ______________
10. Verbal ACT score ______________
11. Have you taken the EIT exam? yes no
   11b. If so, did you pass the EIT exam? yes no
12. Did you enter SFSU Engineering as a freshman (native student) or did you transfer from another institution? Native Transfer
13. Have you submitted job applications or had job interviews? yes no
14. Have you applied to graduate school? yes no
   14a. If so, please circle the area Engineering Business Law Medicine Science Other
14b. If so, have you been accepted to graduate school?  yes  no

**Questions about your SFSU education.**

Please indicate to what extent you agree or disagree with the following statements using the scale below, where

1=Strongly agree  5=Strongly disagree

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have learned to utilize advanced mathematics and general scientific</td>
<td>1   2   3   4   5</td>
<td></td>
</tr>
<tr>
<td>principles for solving practical engineering problems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I have learned to identify, formulate, and solve engineering problems.</td>
<td>1   2   3   4   5</td>
<td></td>
</tr>
<tr>
<td>3. I have learned to design and conduct experiments.</td>
<td>1   2   3   4   5</td>
<td></td>
</tr>
<tr>
<td>4. I have learned to analyze and interpret experimental data.</td>
<td>1   2   3   4   5</td>
<td></td>
</tr>
</tbody>
</table>

**Continued on other side**
5. I have learned to work effectively in multi-disciplinary teams.  
6. I have learned to present technical information clearly in oral presentations.  
7. I have learned to present technical information clearly in written reports.  
8. I have learned to analyze and design systems, components, or processes relevant to my field of specialty.  
9. I have learned to use computer applications for solving practical engineering problems.  
10. I have the foundation for learning new information and procedures.  
11. I have gained an awareness of the impact of engineering solutions in a global and societal context.  
12. I have gained an awareness of contemporary issues and their relationship to engineering.  
13. I have gained an awareness of my professional and ethical responsibilities as an engineer.  
14. I believe it is important to continue learning throughout my professional career.  
15. My senior project was a valuable part of my educational experience.  
16. I feel well-prepared to enter my chosen field.  
17. I found the computer facilities at SFSU to be satisfactory.  
18. I found the laboratory facilities at SFSU to be satisfactory.  
19. In general, engineering faculty are accessible and helpful.  
20. The engineering faculty are knowledgeable about their subject area.  
21. The advice I received from my engineering advisor regarding the engineering curriculum was helpful.  
22. The advice I received from the engineering GE advisor regarding general education requirements was helpful.

Please provide any comments you have on the faculty, courses, or other aspects of the School of Engineering.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

283
Civil Engineering

Civil Engineering is the practice of planning, designing, and constructing public and private works, such as buildings, bridges, highways, water and wastewater treatment plants, and environmental remediation facilities. The civil engineering program at SFSU prepares graduates to meet the demands of the profession. The faculty is professionally active and brings this experience into the classroom.

Students at SFSU obtain a basic and comprehensive background in engineering sciences and civil engineering. Elective courses during the senior year of study provide students with further specialization in selected areas of civil engineering. Practical applications and design methods are presented throughout the curriculum. Students complete several design projects during the course of their studies, including a major design project during the final year.

The bachelor of Science in Civil Engineering requires 127 units. Mathematics, Chemistry, Physics and Civil engineering courses constitute 91 units, with the remaining 36 units in general education. The degree program is accredited by the Accreditation Board for Engineering and Technology (ABET).

Careers in Civil Engineering

Graduates with a BS degree in Civil Engineering find career opportunities in design, analysis, and construction of environmental projects, waste treatment facilities, buildings, bridges, dams, and transportation systems. Employment opportunities are offered by large corporations, small consulting firms, and government agencies. Some civil engineering form their own consulting firms after gaining practical experience.

Civil engineering students interested in management and business aspects of the profession may wish to pursue a Master’s degree in Engineering Management or Business Administration. Those interested in research, development, or college level teaching can pursue an MS or Ph.D. degree in a specialized area of civil engineering.

Admission

Freshman applicants should complete four years of mathematics and one year each of chemistry and physics in high school. Students are also encouraged to include one year of mechanical drawing.

Community college transfers should complete the sequence of mathematics, chemistry, physics, and engineering courses listed under freshman and sophomore years (opposite side of this brochure) if available at the community college.

All applicants must satisfy the general requirements for admission to the University. Admission requirements as well as other official requirements are published in the University Bulletin.

How to Apply

All students must submit the regular California State University application for admission. To assure optimal consideration for admission, applications should be submitted within the open filling period of the University. For a Fall semester, this would be November 1 to 30, and for a Spring semester, August 1 to 31.

Send applications to:

Office of Admissions
San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132

Office of Admissions: (415)338-1113
WebSite: http://www.sfsu.edu

School of Engineering: (415)338-1228
Web Site: http://engineering.sfsu.edu
# School of Engineering

## Bachelor of Science in Civil Engineering

### FRESHMAN YEAR

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<thead>
<tr>
<th>First Semester</th>
<th>Units</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>CHEM 180 Chemistry for the Energy and the Environment</td>
<td>3</td>
<td>MATH 227 Calculus II</td>
</tr>
<tr>
<td>MATH 226 Calculus I</td>
<td>4</td>
<td>PHYS 220/222 Physics I and Physics I Lab</td>
</tr>
<tr>
<td>ENGR 100 Introduction to Engineering</td>
<td>1</td>
<td>ENGR 103 Introduction to Computers*</td>
</tr>
<tr>
<td>ENGR 101 Engineering Graphics</td>
<td>1</td>
<td>Oral Communications</td>
</tr>
<tr>
<td>ENGL 114 First Year Written Composition</td>
<td>3</td>
<td>General Education Elective</td>
</tr>
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<td>U.S. History or Government</td>
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### SOPHOMORE YEAR

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<tr>
<th>Third Semester</th>
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<tbody>
<tr>
<td>MATH 228 Calculus III</td>
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<td>MATH 245 Differential Equations &amp; Linear Algebra</td>
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<tr>
<td>PHYS 230/232 Physics II and Physics II Laboratory</td>
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<td>ENGR 102 Statics</td>
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<td>ENGR 235 Surveying</td>
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<td>ENGR 200 Materials of Engineering</td>
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<td>ENGR 201 Dynamics</td>
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<tr>
<td>ENGL 214 Second Year Written Composition</td>
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<td>ENGR 205 Electric Circuits</td>
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### JUNIOR YEAR
**Fifth Semester**  

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<td>ENGR 300 Engineering Experimentation</td>
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<td>ENGR 304 Mechanics of Fluids</td>
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<td>ENGR 309 Mechanics of Solids</td>
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<td>ENGR 434 Principles of Environment Engineering</td>
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**Total**  

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**Sixth Semester**  

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<td>ENGR 323 Structural Analysis</td>
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<td>ENGR 429 Construction Management</td>
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<td>ENGR 436 Transportation Engineering</td>
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**SENIOR YEAR**

**Seventh Semester**  

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**Eighth Semester**  

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**ELECTIVES**

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<td>ENGR 461 Mechanical &amp; Structural Vibration</td>
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<td>ENGR 468 Applied Fluid Mech and Hydraulics</td>
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