Foothill has amazing faculty, staff, administrators, and programs. Program Review is about documenting the discussions and plans you have for sustaining and improving student success in your program. It is also about linking your plans to decisions about resource allocations. Thank you for taking the time to review your program and sharing your findings with the college community!

Program Review Committee Members for 2017-18:

Administrators
- Andrew LaManque
- Paul Starer
- Teresa Ong

Faculty
- Carolyn Holcroft
- Bruce Mc Leod
- K Allison Meezan;

Classified Staff
- Craig Gawlick
- Vacant
- Vacant

- Elaine Kuo (Ex Officio)

Let us know how we can help you!
https://foothill.edu/staff/irs/programplans/index.php

BASIC PROGRAM INFORMATION

Department Name: Engineering

Division Name: PSME

Please list all team members who participated in this Program Review:

Name	Department	Position
Sarah Parikh	Engineering and Physics	Faculty
Sue Wang	Engineering and Physics	Faculty

Number of Full Time Faculty: 2 **Number of Part Time Faculty:** 10

Please list all existing Classified positions: *Example: Administrative Assistant I*

Jenny Liang

List all programs covered by this review* and indicate the program type:

Engineering	☐ Certificate	☒ AA / AS	☐ AD-T	☐ Pathway
	☐ Certificate	☐ AA / AS	☐ AD-T	☐ Pathway
	☐ Certificate	☐ AA / AS	☐ AD-T	☐ Pathway
	☐ Certificate	☐ AA / AS	☐ AD-T	☐ Pathway
	☐ Certificate	☐ AA / AS	☐ AD-T	☐ Pathway

*Not sure? Check: https://foothill.edu/programs/ and click to sort using the "Areas of study/Divisions" button Current pathways at Foothill College include: ESLL, NCEL, ENGL pathways (ENGL 209-110-1A; ENGL 209-1A; ENGL 1S/1T); MATH pathways (NCBS 401A/B; MATH 235-230-220-105; MATH 217-57).

SECTION 1: PROGRAM ENROLLMENT, PRODUCTIVITY, AND COMPLETION

Data will be posted on Institutional Research's website for all measures except non-transcriptable completion.

1A. Analysis of Transcriptable Program Completion Data: Please use your data to complete the following table.

Transcriptable Program	Five-year trend in degrees/certificates awarded	Comments
e.g. Associate Degree for Transfer	The number AD-Ts awarded has been steadily increasing each year, up to a high of 39 degrees awarded in 16-17	We are pleased to see this trend and believe it will continue as more students pursue AD-Ts
Engr AS	Overall, the number of AS degrees awarded has stayed relatively steady.	There is a large gap between the number who declare the Engr major (about 540) and those who receive it (4 in 2016-17). More details on a plan to look into this gap are in section 2c. The Engr AS degree is not requested as commonly as and Engineering BS, so many students may not actually intend to get the AS on their way to getting the BS degree.

*according to CCCApply data

1B. Non-Transcriptable Program Data: If your program offers any non-transcriptable programs, please complete the following table. Institutional Research does not track this data; each program is responsible for tracking its own data.

Non-Transcriptable Program	Comments	Five-year trend	Rationale for program
e.g. Certificate of Proficiency in xx	We anticipate that this trend will continue because enrollment in the core classes for this certificate is holding steady	The number of completers has remained steady at around 9 per year	This credential boosts potential for job advancement in the xx industry. We receive positive feedback from employers (link to advisory committee minutes)

The 2017-18 College Strategic Objectives (E^2SG) operationalize the college's 3 EMP goals and include:

> **Equity**– Develop an integrated plan; identify goals for alignment with equity, student success, and basic skills; and focus on efforts to integrate with enrollment strategies (access, retention, and persistence) to close equity gaps while increasing enrollments at the same.
> **Enrollment Growth** – Achieve more than 1.5% FTES growth at 500 productivity (+/- 25) with attention to integrating equity efforts related to enrollment, CTE, and Sunnyvale Center. Consider how the pathway/course sequence through your program is disseminated to students, and *education pathway.

*Education pathway is a having developed and published clear, structured academic program maps (suggested courses for each term) for all academic programs.

1C. Course Enrollment: Enrollment is a count of every student who received a final grade (A, B, C, D, F, P, NP, W) in your program's courses. It also serves as an indicator for program viability. Please use your program review data to examine your course enrollment trends and check the appropriate box below.

5-year Enrollment Trend: ☒ Increase ☐ Steady/No Change ☐ Decrease

Our college goal is to increase enrollment by 1.5% FTES this year. What steps might you take to increase the numbers of students enrolling in your courses? Steps might include cross department collaborations, actions to increase retention, service learning projects, support for student clubs, participation at recruitment events, examination of pre-requisites, review of assessment results, etc.

The Engineering Department has seen sustained long-term growth, with our enrollment increasing by 133% over the last five years. We attribute this growth to a number of new and improved courses, the work that has been done on community building and outreach, and the dedication that the Physics and Engineering departments have made to professional development. Unduplicated headcount has grown by only 115% during that time, letting us know that there has been an increase in the number of students taking multiple engineering courses while at Foothill.

To further increase enrollment, the Engineering Department has partnered with the STEM Core program which has led to an increase in enrollments for courses associated with the program. We have also offered Engr 37 online which accommodates students from other schools with scheduling conflicts. We are in the process of reaching out to students who have declared their major as engineering but have perhaps not taken any engineering courses by sending an email welcoming them and connecting them to student clubs and course information. The expected outcome of this welcome email experiment is to increase engineering course enrollments. Additionally, the Engr 10 Introduction to Engineering course has redesigned its final project to be a service learning project where students design solutions that can be implemented here at Foothill to make the campus more sustainable and more connected. The visibility of these projects will be increased this year through collaborating with the Business Innovation Challenge and other service learning sharing opportunities. Other ideas to increase enrollment include reaching out to families of students from targeted groups, specifically first in family students, to let them know how they can support their college student.

Overall, our retention is quite good. As we recruit new populations of students we will need to think about how their backgrounds and skills may differ from our previous populations, and what support we can provide to help close any gaps. We will be holding meetings every-other week during the Winter Quarter to discuss potential ideas for increasing enrollment and supporting our students.

1E. Productivity: Productivity is a measure of students served per full-time equivalent faculty and is a factor in program viability. Please use your program review data sheet to examine your productivity trends and check the appropriate box below.

5-year Program Productivity Trend: ☐ Increase ☒ Steady/No Change ☐ Decrease

The college productivity goal is **500 (+-25)**. There are many factors that affect productivity (i.e. seat count/ facilities/accreditation restrictions, curriculum, etc.). Please discuss factors that may be affecting your program's productivity trends and any plans you have for addressing the trends, especially if they are declining.

Engineering productivity has been steady and low (312) due to courses that are not completely full. When the Program Review Tool became available, the engineering department took the opportunity to investigate our low productivity by looking at the productivity that we have for each engineering course (14 courses offered during 2015-2016). A line was drawn and the department focused on what could be done about the eight courses with lowest productivity (Engr 40, 45, 47, 49, 83A, 83B, 83C, 83D). After making the changes that we could and seeing their effects into 2016-2017 data, some decisions have been made to those 8 eight courses which should increase the Engineering Department productivity for 2017-2018. First the good news, Engr 47 and 49 saw substantial increases in productivity over the one-year period. The productivity for Engr 45 remained steady, but the Engineering Department and the Dean have decided to offer the course only once a year and as a triple section to hopefully increase its productivity for 2017-2018. Based on a lack of significant growth in productivity, the Engineering Department and the Dean have decided to not offer Engr 40, 83A, 83B, 83C, and 83D this year.

After investigating the eight courses with the lowest productivity, we are now turning our attention to ways to maximize the productivity for all eight of the courses that we plan to continue to offer this year: Engr 6, 10, 11, 35, 37, 37L, 45, and 47 (the decision to eliminate Engr 49 was made by the dean). While there are some limits on class size for some laboratory courses (Engr 6, 10, 11, 37L, and 45), the more advanced courses that do not have a lab component have the potential to support a larger audience (Engr 35, 37, 46, and 47). Some of our ideas for increasing productivity and enrollments include teaching courses without labs online which may increase access to education for a broader audience of students.

Engineering courses do typically have smaller class sizes than other majors because of the number of prerequisites that limit the potential pool of available students. This is typical of engineering programs at other community colleges as well.

Ultimately, the Engineering department has created a complete and robust engineering program of core transferrable courses that are needed in different combinations for each of the 273 different transfer pathways from Foothill Engineering to the institutions on assist.org. Now that it has been built and established, it should be advertised. Faculty members in the engineering department are attempting to market the courses on their own, and support from the administration would aid in their efforts.

SECTION 2: COURSE COMPLETION & STUDENT ACHIEVEMENT

2A. Institutional Standard: This percentage represents the lowest course completion (success) rate deemed acceptable by the College's accrediting body (ACCJC). The institutional standard during the year for which this program review is being written (2016-17) is **57%**.
Please check the appropriate box:

Program Level Course Completion: ☒ Above Standard ☐ At Standard ☐ Below Standard

If your program's course completion (success) rates are below the institutional standard (see above), please discuss your program objectives aimed at addressing this.

2B. Institutional Effectiveness (IEPI) Goal: This percentage represents an aspirational goal for course completion (success) rates; all programs should strive to reach/surpass this goal. The IEPI goal for which this program review is being written (2016-17) is **77%**.
Please check the appropriate box:

Program Level Course Completion: ☒ Above Goal ☐ At Goal ☐ Below Goal

If your program's course completion (success) rate is **ABOVE** the IEPI goal, please share your thoughts about why/how this is so (we hope to learn from your effective practices!).

Engineering courses have high success rates (steady at 83% over the last 5 years) for two reasons. First, many of the courses have prerequisites that include Calculus, Physics, and Chemistry. Students who have made it through those prerequisite courses have learned many of the skills necessary to do well in the advanced engineering courses. Second, we have worked very hard to create a supportive community in engineering. Faculty members in Engineering get to know students and work closely with them. Additionally, the Engineering courses provide opportunities for students to work together and support each other's learning.

Third, the introductory level engineering courses that do not have prerequisites (Engr 6 and 10) have been designed with a lot of thought about what knowledge and skills the students should learn in the course and how to teach and test those skills without also assessing skills that are not required. Many courses have a mismatch between the stated prerequisites and the knowledge and skills that are actually required for the course. For example, a technical course may not have an English prerequisite, but students would need to have skills in reading and writing technical documents in order to really do well in the course. For Engr 10, we had previously seen this in terms of writing and reading requirements and math concepts. We decided to change the assignments so that they no longer required these skills that were not a prerequisite. For the technical writing skills that we wish students to develop, we present the material assuming that students do not have previous experience with it. The challenge for us as instructors is to keep the students who are already familiar with the concepts engaged. One of my favorite ways to do that is to ask the more advanced students to share their perspectives and build upon the knowledge that already exists in the classroom. Additionally, we are mindful that some students take longer to formulate their written responses, and we make writing assignments take-home assignments so that students who need extra time or help can have it. For the math concepts that we recognized as being part of the course, we have opted to change the examples that we use to ones that do not require advanced concepts. When we do introduce math concepts, we assume that this will be

the first time some of the students have encountered it. There isn't much that is different about what is taught, only the speed and patience we have in going through the material. Because some students have already completed the calculus sequence we are mindful of how much time is spent on concepts that they may feel are basic.

2C. Course Success Demographics: Please examine the **"**Disproportionate Impact data by year**"** shared with your department and discuss actions you are taking, or plan to take, to address any achievement disparities identified in your program. If you are uncertain about actions faculty can take, please take a look at Appendix A.

First, we would like to celebrate that students in the Latino/a category have a success rate (83%) that matches the success rate of the department as a whole (83%)! While we have taken steps to have engineering be a welcoming environment, we credit the STEM Core program with much of this success. Some of the things that the STEM Core program brings include accountability as the students will receive email and text messages if they are late to class, support as the students' progress is monitored and students are connected with tutors as needed, and community as the students spend a good amount of time together at events and in the same classes. We should definitely look to expand these practices to a larger number of engineering courses. Some of the things that we have done to make engineering more welcoming including having full-time and part-time instructors attend professional development workshops including the National Association of Partners in Equity Micromessaging workshop and the small-group follow-up meetings afterward.

Second, we would like to celebrate the overall course success for Targeted Groups increased from a steady 73% to 82% last year. The success rate for women was 79% as compared to men at 84%, while the percentage of women in engineering has increased from 14% five years ago to 19% last year (down slightly from a high of 21% from the year before that). Additionally, over the last five years, the percentage of enrolled students from African American (3% to 4%), Latino/a (12% to 16%), and Pacific Islander (0% to 2%) categories have all seen steady increases.

From the Disproportionate Impact data by year page, we see that students who are African American, Pacific Islander, Foster youth, or Students with Disabilities all have success rates that are under the Institutional Effectiveness goal of (77%). While it is hard to read much into the data because these are categories with a low overall number of students, it is likely that a combination of stereotype threat and a lack of sense of belonging are playing a role in the persistence of these students.

One prevailing theory is that sense of identity and persistence are related. The idea is that someone with a strong sense of engineering identity is more likely to stick with engineering when they encounter bumps in the road. We are working on applying that theory here at Foothill in the form of a research project carried out with collaboration from Stanford University. This project will reach out to some of the 540 students who have declared the Engineering as their major. The first step in the research project that is expected to begin by the end of the year 2017 is to determine a baseline level of engineering identity for our students. Then, in addition to determining if there is a correlation with persistence, we can formulate support for our students tailored to the needs that we see expressed in the engineering identity survey. Furthermore, in the future, we can look into the needs of students in the demographic groups that show largest gaps to see how supports can be designed to help close the gap. Of particular interest would be students experiencing intersectionality of groups that both have negative stereotypes in engineering. Our data from Institutional Research show that less than 1.3% of the students with a declared Engineering major identify as both African American and female. The specific needs of students experiencing intersectionality should be considered in order to better support all students. While this initial research will be carried out by our partner school, Stanford, additional funds may be needed for survey and statistical software to be able to extend our data collection and analysis in the future.

Be sure to include the resources you need to implement or sustain your action plans in Section 3.

2E. Faculty Discussion: Course-Level Outcomes: Please share examples of how assessment and reflection of course-level Student Learning Outcomes (CL-SLOs) has led to changes in curriculum or teaching.

Assessment and reflection on SLOs is instrumental in helping instructors to make changes to their courses. One of the key results of going through the SLO process is the habit of critically thinking about what are the essential knowledge and skills that students should develop during a course. This has also been helpful for instructors of introductory courses in teasing apart what is required knowledge from prerequisite knowledge. Overall, the success rates for engineering courses are high. There is room for growth in the department-wide discussions on SLOs and this may be supported with additional professional development for engineering full-time and part-time instructors.

One example is that we have changed more of the activities to focus on the desired student learning outcomes by really focusing on the free-body-diagrams in the instruction, practice, and testing for Engineering Statics.

2E. Faculty Discussion: Program-Level Outcomes: Please provide examples of what is being done at the program-level to assist students in achieving your Program-Level Learning Outcomes, degree/certificate completion, and/or transferring to a four-year institution (e.g. review of progress through the program, "career days"/open houses, mentoring, education pathways (clear, structured academic program maps (suggested courses for each term) for all academic programs), etc.). If your program has other program-level outcomes assessments (beyond SLOs and labor market data), discuss how that information has been used to make program changes and/or improvements.

Program-level Learning Outcomes have been assessed by achievements in core engineering courses. Because of the nature of the program with there being 273 different pathways from Foothill Engineering, there is not one set of courses or sequence of courses that all engineering students need to take. Getting data on who has completed the program successfully has been a major challenge. Ultimately, we are interested in helping Foothill engineering students to transfer into engineering programs at four-year institutions.

After look into many different methods for determining if students are transferring into engineering programs, we have resolved that the engineering department will track students itself. The research project discussed in section 2C will be a great first step in looking at students, their goals, and their needs more closely. Understanding what our students need will help us to best provide support. A supportive program should see improvements in enrollment and success rates as well as increased transfer rates, degree attainment, and job placement, for which we need to first establish a baseline. We plan to contact and keep in touch with students through email and will work with Institutional Research to do so in an appropriate way for research and program improvement purposes.

Please attach Course and Program-Level Outcomes (Four Column Report from TracDat).
Contact the Office of Instruction if you need help.

If your department has a Workforce/CTE program, please complete Section 2F.
If your department does not have a Workforce/CTE program, please skip to Section 3.

2F. Workforce/CTE Programs: Refer to the program review website for labor market data.

What is the regional five-year projected occupational growth for your program?

What is being done at the program-level to meet/adjust to the projected labor market changes?

What is being done at the program-level to assist students with job placement and workforce preparedness?

Be sure to include the resources you need to implement or sustain your action plans in Section 3.

SECTION 3: SUMMARY OF PROGRAM OBJECTIVES & RESOURCE REQUESTS

3A. Past Program Objectives: Please list program objectives (<u>not resource requests</u>) from past program reviews and provide an update by checking the appropriate status box.

Previous program objectives related to Physics and will be commented on in the Physics program review	Year:	☐ Completed	☐ Ongoing	☐ No Longer a Goal
	Year:	☐ Completed	☐ Ongoing	☐ No Longer a Goal
	Year:	☐ Completed	☐ Ongoing	☐ No Longer a Goal
	Year:	☐ Completed	☐ Ongoing	☐ No Longer a Goal
	Year:	☐ Completed	☐ Ongoing	☐ No Longer a Goal

Please comment on any challenges or obstacles with ongoing past objectives.

Please provide rationale behind any objectives that are no longer a priority for the program.

3B. Current Program Objectives and Resource Requests: Please list all new and ongoing program objectives based on discussion in Sections 1 and 2, including your objectives to eliminate any achievement disparities in course success for student subgroups (Section 2A). If additional resources are needed, indicate them in the table below. Refer to the Operations Planning Committee (OPC) website for rubrics and resource allocation information.

Resource Request	Program Objective	Implementation Timeline	Progress Measures	Resource Type Requested*	Estimated cost
	Example: Offer 2 New Courses to Meet Demand	*Winter 2016 Term*	*Course Enrollment*		
Marketing support	Increasing enrollment	Winter and spring 2018	Course enrollment	Ongoing B-budget	
Professional development	Better understanding of the needs of our students and better understanding of action items based on SLO reflections	Spring and summer 2018	course success rates for disproportionately impacted groups	New Faculty	$50*8*number of PT faculty attending +$25*8*number of PT and FT attending ($5200)
None so far (resource requests will be placed based on the findings from Sarah's Sp18 PDL that focuses on this topic)	Increase the percentage of women and other URMs enrolled in engineering courses	While gains are hoped for each year, the timeline for reaching parity (50%) in enrollment is several years away	Course enrollment by women and URMs		None so far
Stipend compensation	Develop online materials so that more Engr courses can be offered fully online (potentially increasing enrollment)	Winter, Spring, and Summer 2018	Number of Engr courses ready to be taught online	One-time B budget	$2000 per course

*Resource type should indicate one of the following: One-time B-budget; Ongoing B-budget augmentation; Facilities/Equipment; New faculty/staff.

3C. Faculty/Staff Position Requests: Please describe the rationale for any new faculty or staff positions your program is requesting:

none

3D. Unbudgeted Reassigned Time: Please list and provide rationale for requested reassign time.

none

3E. Please review any resource requests granted over the last five years and whether it facilitated student success.

none

SECTION 4: PROGRAM SUMMARY

4A. Prior Feedback: Address the concerns or recommendations made in prior program review cycles, including any feedback from the Dean/VP, Program Review Committee (PRC), etc.

Concern/Recommendation	Comments
Enrollment of women and URMs	About 50% of the Engineering faculty (FT +PT) attended the Micromessaging workshop on how to help underrepresented students to feel welcome in the classroom. STEM Core has partnered with Engr 10, Engr 49, and Engr 6 which has led to increased enrollments of Latino students for those sections. The success rate for women has remained similar to the success rate for men. The success rate gap for Latino/a students has closed to 0 for 2016-2017. This may be due to the support provided through the STEM Core program.
Training for PT faculty while FT faculty are on PDL	Sarah has some Professional Development ideas including a workshop. Based on interested from PT faculty, a series of meetings will be held every other week during the Winter 2018 quarter. The purpose of the meetings is to align teaching and learning goals and to share successful teaching and learning methods.
More lab room needed	This does not seem to be a concern at the moment, as Engr 10 has offered sections in the morning.

4B. Summary: What else would you like to highlight about your program (e.g. innovative initiatives, collaborations, community service/outreach projects, etc.)?

Service leadership projects have been incorporated into Engr 10 Introduction to Engineering. Students take on a five week project of their own choosing. They are asked to identify the problem, investigate the details surrounding it, and design a solution including a prototype. The students learn how to apply the engineering tools that were taught during the course in addition to authentic experience working in teams and with their own project management. The projects have covered a wide range of topics from assistive technology, medical devices, apps to help students connect with one another, and a number of solutions to parking and traffic issues at Foothill. These wonderful projects could be showcased in local news as well. STEM Newsletter is still be coordinated and sent out by faculty in the Engineering department. It has grown to have 3,682 subscribers. This is an important way to communicate with students about events, student clubs, STEM Center hours, and scholarship and internship opportunities. This weekly newsletter uses the Dada mail system, and we anxiously await the new system and hope that the transition will be

smooth.

Faculty from the Engineering Department has initiated research on how to better serve our students. The work is ongoing and preliminary results will be available in Fall 2018. If the results are promising, the project may be continued or expanded to include students who have applied to Foothill but have not enrolled in courses. Depending on the success that the Engineering Department sees, other departments may decide to follow suit and reach out to their own students and applicants. My understanding is that there is a rather large number of students who apply, but then never enroll. This may be a great opportunity to increase enrollment for the college.

STEM Showcase has been institutionalized! Fall 2018 marks the 8th STEM Showcase event. This event has grown to include multiple rooms in the STEM Center. It is now managed entirely by Eric Reed. I am proud to say that this event that was started by an Engineering faculty member has been institutionalized.

SECTION 6: FEEDBACK AND FOLLOW-UP

This section is for the Dean/Supervising Administrator to provide feedback.

6A. Strengths and successes of the program as evidenced by the data and analysis:

There are three major strengths to the ENGR program:

1. Student success data is impressive. The overall student success data is 83% and that for latinx students is also 83%. The fact that there is no equity gap is commendable. The faculty should continue to foster the environment they are providing for students to excel in their coursework.
2. The incorporation of service leadership projects within the existing curriculum is a major strength to the ENGR program. This can serve as a model for other disciplines. Engaging students in real-world experiences in introductory classes may also be directly correlated to the high course success data.
3. The variety of course offerings in ENGR at Foothill College is unique in comparison to other community colleges statewide. Students have an opportunity to complete coursework in subjects such as Strength of Materials, which are then used to form transfer agreements to guarantee transfer to universities with strong ENGR programs. This is an attractive recruitment tool.

6B. Areas of concern, if any:

There are two major concerns:

1. Enrollment in the more specialized/advanced classes mentioned in 6A.3 is low. Even though the overall enrollment has been increasing steadily, the enrollment in individual sections is often much lower than division averages.
2. Overall productivity is much lower than college standards: productivity is around 300. This has made it a challenge to offer the more specialized/advanced classes that tend to have low enrollment.

6C. Recommendations for improvement:

The major recommendations are as follows:

1. Continue to implement all the strategies that have contributed to student success.
2. Continue to incorporate service-learning projects within existing course curriculum and perhaps even look to expanding this to beyond the introductory classes.
3. In order to build enrollment, strengthen the enrollment in core classes such as ENGR 6, 10, 11, 35, and 37. Once a large enough cohort of students has completed these classes, there should be a sizeable number of students requiring the more advanced classes. We are already seeing some initial benefits of this strategy. Since trimming the schedule this winter quarter, the current productivity for the winter quarter is > 450
4. Also, limit the offerings of the advanced courses to once every other year.
5. Draft a yearlong schedule of classes and publish this in the department website and make this information available to counselors so that students can plan their schedule appropriately.
6. The Bio-medical program, which has essentially operated somewhat independently from the main ENGR program has been temporarily placed on hiatus due to extremely poor enrollments and lack of demand. A discussion with appropriate offices on campus is needed to examine the viability of this program.

6D. Recommended Next Steps:

☒ Proceed as Planned on Program Review Schedule
☐ Further Review / Out-of-Cycle In-Depth Review

This section is for the Vice President/President to provide feedback.

6E. Strengths and successes of the program as evidenced by the data and analysis:

6F. Areas of concern, if any:

6G. Recommendations for improvement:

6H. Recommended Next Steps:

☐ Proceed as Planned on Program Review Schedule
☐ Further Review / Out-of-Cycle In-Depth Review

Upon completion of Section 6, the Program Review document should be returned to department faculty/staff for review, then submitted to the Office of Instruction and Institutional Research for public posting. Please refer to the Program Review timeline.