Instructional Program Review Report
Sierra College, 2016-17

Department/Program Name: Engineering Department, Math & Science Division

Date Submitted: 01/30/2017

Submitted By: Philip H. Pattengale

Ideally, the writing of a Program Review Report should be a collaborative process of full-time and part time faculty as well as the appropriate educational administrator, instructional assistants, classified staff members and students who have an interest in the present and future vision of the program at all sites throughout the district. The Program Review Committee needs as much information as possible to evaluate the past and current performance, assessment, and planning of your program.

Please attach your Department Statistics Report (DSR) and your ePAR Report when sending in your Program Review.

1) __Relevancy__: **This section assesses the program's significance to its students, the college, and the community.**

    1a) To provide context for the information that follows, describe the basic functions of your program.

> The engineering program at Sierra College is geared toward two ends. First and foremost, we serve students who plan to earn a four year professional engineering degree at an accredited university. These are transfer students. This student will complete the first two years of the four year engineering degree here at Sierra College and transfer on to institutions like California State University Sacramento and U.C. Davis as a third year student (Junior Level) within the college of engineering at that university. Second, the engineering department serves students who are interested in a two year degree (Associates Science) or certificate. This path is created for an engineering student that would like to learn the practice of engineering but not complete the full four years of a professional engineering degree at the university level. This targets students that are unable or unwilling to complete the advanced math, physics, and engineering courses but desire to work in the field as an assistant to an engineer.

    1b) How does your program support the district mission, as quoted below? Please include an analysis of how your program supports ISLOs (Institutional Student Learning Outcomes): Communication, Technology and Information Competency, Critical and Creative Thinking, and Citizenship?

> *"Sierra College provides an academic environment that is challenging and supportive for students of diverse backgrounds, needs, abilities, and goals with a focus on access, equity, student-centered learning, and achievement. The college is committed to practicing diversity and inclusion, and recognizes that a diverse and inclusive curriculum and workforce promotes its educational goals and values. Institutional learning outcomes guide the college's programs and services, encouraging students to identify and expand their potential by developing knowledge, skills, and values to be*

fully engaged and contributing members of the global community. Sierra prepares students by offering Associate's and transfer degrees, certificates, career and technical education, foundational skills, as well as lifelong learning and enrichment."

The first sentence of the mission statement focuses on supporting a top notch learning environment for transfer and CTE students. This is the core mission for the engineering program as well, to provide a supportive yet challenging learning environment that prepares students well for transfer success (as you will find herein) or for a job as an engineering technician be that the choice of the engineering student. The engineering students that complete a Sierra College degree and/or transfer are notoriously successful which is verified by other institutions (both CSUS and UCD) as the Sierra College students have the highest success rates, many times exceeding the native student population. The engineering department at Sierra College has come to understand this by working closely with those local universities.

1c) Program offerings align with which of the following mission categories (check all that apply):

☒Transfer ☒Career Technical Education
☐Basic Skills ☐Personal Development/Enrichment   ☐Lifelong Learning

1d) Please analyze your department's role and its success in supporting the mission categories marked in 1c above. Please provide evidence in support of this analysis. If any of the following apply to your program, please address them in your analysis.
- Degrees, certificates, and/or licenses your department has generated:
  o The alignment of these awards with the district's mission and/or strategic goals. (See the district "Awards Data File, available from Research and Planning, for your numbers).
- Job placement or labor market information for your program's awards and licenses.
- The contribution your program makes to student transfer.
- Participation in basic skills programs.

The number of engineering majors is collected by the research department and shown below. This data is showing that Engineering and Engineering technology are one of the most popular majors on campus and has been growing steadily for the past three years, even as enrollments campus wide have declined. The engineering major shown below represents the transfer students and the engineering technology majors represent the two year degree or certificate students. In all, there are 628 declared engineering students and only one full time instructor. In addition, there are many more student within the engineering program that are not declared engineering.

Majors	Fall 13	Spring 14	Fall 14	Spring 15	Fall 15	Spring 16	3 Yr Avg
Civil Engineering Technology	43	47	49	34	45	42	43.33
Engineering	532	545	582	584	616	569	571.33
General Engineering Technology	12	10	9	13	19	18	13.50

1e) Optional Additional Data: Comment on any other relevant contributions of your program to the district mission, goals, outcomes, and values not incorporated in the answers above. Examples include but are not limited to contributions to student equity and success, diversity, campus climate, cultural enrichment, community ties, partnerships and service, etc. Include specific data and examples.

The engineering department has increased the number of course offerings for ENGR22A (Graphics), the first introductory engineering course. The new section, offered Spring 2017 semester, filled before the semester start and included six students on the wait list. This is further evidence of the demand for engineering courses by Sierra College students.

2) **Currency:** This category assesses the currency of program curricula as dictated by Title 5 and the currency of efforts in meeting accreditation standards as well as improving pedagogy and engaging in professional development.

2a) Curriculum: Comment on the currency of your program's curricula, including discussion of any recent or projected changes. Please describe your process for evaluating and revising curriculum, including the use of SLOs.

The engineering department is 100% current on all curriculum. Last year the Engineering Department was in the curriculum review cycle. In the fall 2016 semester ALL engineering courses were taken through the curriculum review process and approved.

2b) Student Learning Outcomes Assessment: Analyze your program's assessment of course outcomes, analysis of results, and improvements/changes made to the program as a result of this assessment. Please provide specific data and analysis in the space provided. In the space below, please describe or attach the cycle you have developed for outcomes assessment.

The engineering department has assessed all courses with respect to at least two student learning outcomes. It has not assessed all outcomes for all courses. The engineering department has created a road map to assess all outcomes for all courses but that will take more time. Thus far, engineering has exactly adhered to the roadmap and therefor has assessed all classes, which occurs over the course of a three year cycle which we just completed. Upon completion of the second three year cycle, all outcomes for all courses will have completed assessments.

Course Outcomes	# of Active Courses	# Courses Assessed	# Active Learning Outcomes	Outcomes Assessed
	10	6	36	16
Program Outcomes	# of Program Outcomes	Outcomes Assessed		
Curriculum Currency SP 16				

2c) Professional development: Please describe how your department's individual and group activities and professional development efforts serve to improve teaching, learning and scholarship.

There exists a large lack of financial resources to aid in true engineering professional development, such as attending seminars, meetings, and professional training. For this reason, the only planned professional development for this department is to attend 'free' webinars on engineering and Sierra College FLEX activities that focus on improved instruction. It is the hope of this author that the report written rectifies this. It is required that the division fund attending engineering courses and also pay part time instructors to cover the missed classes.

The other avenue for professional development is local industry. The engineering department holds regular meetings with local industry representatives to keep informed of local trends and business. This activity assisted in the completion of one externship for a professor which was sponsored by CTE, numerous internships for students, also sponsored by CTE, attending meetings with CSUS engineering, and several field trips to local industry for the engineering student body.

2d) Optional Additional Data: Enter additional data here that you believe to be an indicator of your program's effectiveness and explain why.

N/A

3) **Effectiveness: This section assesses the effectiveness of the program in light of traditional measurements.**

3a) Retention and Success: Identify and explain the three-year trends in your program's data contained in the DSR.   Address separately the data for on ground and on-line course. Evaluate the significance of the trends, including any challenges experienced by the program and any relevant data/analysis from your course and program outcomes assessments. If applicable, please analyze any significant trends related to student equity and success. If you determine that you need to improve the program's performance, please describe how you plan to achieve this goal. Please include the results of your outcomes assessments, as appropriate.
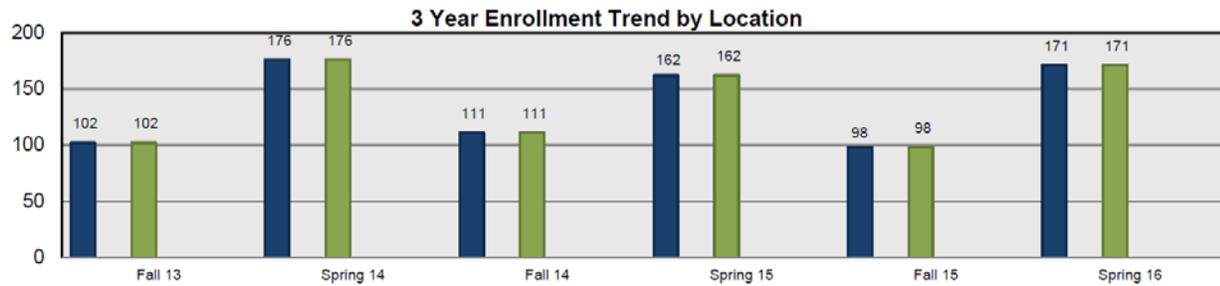
The data below shows that the engineering department has generally exceeded the district retention for the last six semesters. It appears that the overall retention number has stayed about the same, at ~90%, for the last three years. The district retention appears flat as well at a value of ~85%. This is evidence that the engineering department has performed better than average at retaining students. This is a product of the continuous improvement activities executed by the department which are many and listed below in paragraph two.

The success rate data is a bit more variable. As can be seen from the data below, the fall semesters are trending flat at around 67% with a much higher standard deviation and the spring semester has been trending up, achieving a 80% success rate in spring 2016. The fall trend resides slightly below the district average; the reason for this tends to be the newly graduated high school students who come to Sierra College and take the first engineering course in the series and are ill prepared. This was identified by analyzing introductory course SLO data. It seems that many students start out in engineering not quite understanding the commitment level required and then struggle to find success. The department has done more lately to help students inENGR22A (the introductory class) to understand this in hopes of a positive trend change. The department also worked with the counseling department to identify a pathway that has students not take this class for their first semester in college. The department success rate for the spring semester has trended upward for the last three years, going from 74%, to 78%, and then finally to 80%. This is again attributed to the continuous improvement activities. These include: course time slot optimization, course material refinement, improved instructional methods, introduction of new technology in the classroom, new engineering machines, new software, the integration of expanded web services into the Canvas course software (YouTube videos), increased effort and accuracy in grading student's work, and reorganized/optimized facilities.

3 Year Retention and Success Percentage Trend
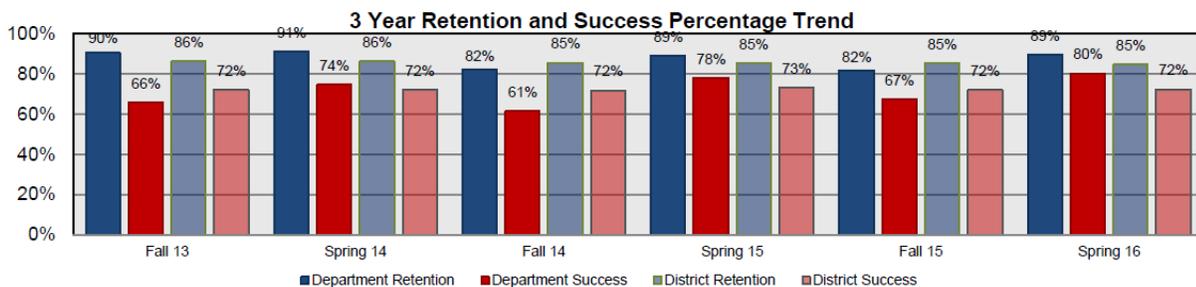
3b) Enrollment Trends: Identify and explain the three-year enrollment trends in your program's DSR data. Address separately the data for on ground and on-line, as well as the data at the various centers in which your program may operate. Evaluate the significance of the trends including any challenges experienced by the program. If applicable, please analyze any significant trends related to student equity and success. If you determine that you need to improve the program's performance in any way, please describe how you plan to achieve this goal.

All engineering courses offered by Sierra College are located at the Rocklin campus and there are no plans to change this. The enrollment trend is flat on average, with a small standard deviation. The reason for this is the course offerings remaining static for the past three years. The course offerings have needed to remain static because of facilities constraints; there simply was not enough classroom space to offer more sections. For the Spring 2017 semester, Engineering and Physics reorganized the classroom utilization to accommodate a second offering of ENGR22A. This class, as with most engineering classes, must be in a particular room (V-318) as it utilizes a computer lab and requires that all students have access to a PC during lecture. Physics and Engineering were able to move some physics lectures back to the V building. This opened up V-318 for a second section. It is expected that the numbers begin to trend upward starting with the Spring 2017 semester due to this modification.

3 Year Enrollment Trend by Location

	Fall 13	Spring 14	Fall 14	Spring 15	Fall 15	Spring 16
Series 1	102	176	111	162	98	171
Series 2	102	176	111	162	98	171

3c) Productivity: Comment on how the program contributes to overall district productivity. Evaluate the significance of the trends including any challenges experienced by the program. If you believe the statistical trends need improvement, and can be affected by your actions, If you determine that you need to improve the program's performance in any way, please describe how you plan to achieve this goal.

The FTES data appears to be trending up slightly while the efficiency data appears to be trending down slightly; although it is difficult to conclude that an exact trend exists with the numbers changing to such a slight degree.

The FTES appears to be trending up slightly, as is the enrollment numbers in engineering and for the same reasons as listed above. The 'productivity' of the Sierra College Engineering Department is below the district level because the engineering courses at Sierra College include many labs utilize large machines and are very hands-on, thus require a small class size. Both safety and not having enough equipment necessitate this. This effect goes back to the lacking financial resources. If more equipment were purchased or if new facilities were available, then the efficiency may begin to trend up. Lastly the author would like to comment on the concept of productivity or "efficiency" as it is measured. If it is the true core mission of this institution to educate students to be successful in transfer and within the labor market, then this measure of efficiency should be inverted. Instructional theory (teaching methodology) has been experimentally shown, time-and-time again, that students learn best and are most successful in smaller class sizes. This measure of productivity (or efficiency) dis-proportionally incentivizes a large class size. For this reason this metric should not be used to measure the ability to educate students.

3 Year Productivity Trend
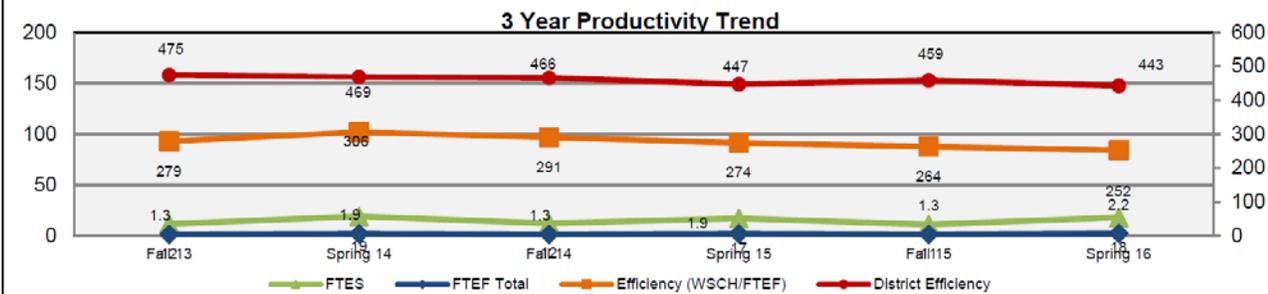
3d) Analysis and Planning: Referring to your ePAR Report of Goals, Strategies, Actions, and outcomes assessment cycle and relevant assessments/evaluations, please describe your program's plans to maintain or increase its effectiveness and analyze and evaluate your efforts to achieve these goals.

The goals of the Engineering Department are as follows:
1. Increase budget for equipment and maintenance
2. Procure new equipment and technology (software)
3. Optimize the engineering program
   3.1 New course offerings (computer programming, increased units for ENGR150)
   3.2 Outreach to local industry, local high schools, and local universities

The engineering program routinely requests increased funding for items 1 and 2 through CTE, the division, and capital outlay funding sources. No sizeable increase has been realized as of yet. The plan is to continue with this course of action. The department is also actively working on both topics in item 3. A new course is currently being written (computer programming using Matlab). Finally, the current full time professor is guest lecturing at local high schools and CSU Sacramento. The department also attends engineering department meetings at CSU Sacramento.

3e) Optional Additional Data: Enter additional data here that you believe to be an indicator of your program's effectiveness and explain why.

N/A

4) **Resources: This category assesses the adequacy of current resources available to the program and describes and justifies the resources required to achieve planning goals by relating program needs to the assessments above. (Refer to the bottom row of your DSR in your response to this category. You may include budget information if you have it.)**

4a) Please describe the future direction and goals of your program for the next three years in terms of sustaining or improving program effectiveness, relevance, and currency. Please incorporate analysis of any relevant outcome or other data in this description.

The engineering faculty at Sierra College has evaluated many other colleges, both two year and four year, and analyzed the data of course offerings. This has shown a need to expand the course offerings to include a new engineering course, computer programming course based in Matlab software. For this reason, the Engineering Department is currently in the process of writing the curriculum for this new engineering course.
The second goal is to continue the push to increase the Engineering Department budget. This would be used for training, equipment procurement and maintenance, and purchasing consumable materials.

4b) Equipment and Technology: Comment on the adequacy of the program's equipment and technology funding level for the District as well as for specific sites, including a projection of equipment and technology needs for the next three years. Please provide a justification for these needs, incorporating relevant assessments of the data above in this explanation.

The computer lab used by engineering (S-105) was recently upgraded to all new computers. This was funded by the division and was well received by the instructors and student population. All software utilized by these computers was installed and updated by the IIT department. The next plan is for new software to be purchased and installed on these computers. The new software is MatLab and will be the basis for the next engineering programming class mentioned above. This will be a new request in the engineering ePAR and hopefully funded by the division or CTE. This is the only current technology request for the engineering program. The current technology is adequate for current needs but requires the new software for the new programming class.

4c) Staffing: Comment on the adequacy of your program's faculty, classified, and student help staffing levels for the overall District as well as specific sites, including a projection of staffing needs for the next three years. Please provide a justification for these needs, incorporating relevant assessments of the data above in this explanation.

At this time, the current level of instructional staffing is adequate.

4d) Facilities: Comment on the program's fill rate and the adequacy of the facilities for the District as well as specific sites, including a projection of facility needs for the next three years. Please provide a justification for these needs, incorporating relevant assessments of the data above in this explanation.

> The fill rate of all introductory engineering courses exceeds 100% (the three introductory engineering classes always exceed capacity). The fill rate of intermediate and capstone engineering courses decreases due to the sequential nature of the program. All intermediate and capstone engineering courses require the successful completion of math (Calculus I/II/II), Chemistry (1A), and physics (205) which are the most difficult courses at Sierra College. That is, many students start out in engineering and then find the difficulty of the program exceeds their expectations so they cease to continue to follow this course of study. This is a common phenomenon regardless of the institution. All engineering courses are challenging and so there exists a stream of students who do not continue. The course offerings are optimized to minimize this effect on fill rate, but because the number of offered seats per class is a constant, the fill rate may only be optimized to a certain level. The engineering program publishes an average fill rate of 87% (aggregated across all courses). This is up from the last program review, completed in 2013, when the average fill rate at that time was 75%. This shows improvement in enrollments.

4e) Please check the appropriate boxes in the chart below indicating the general reasons for the resource requests described above (please check all that apply):

Function/Role	Maintenance	Development	Growth	Safety	Outcomes	Other success measures	No Requests
	XX	XX	XX		XX	XX	

5) Summary/Closing

5a) Based on the analysis above, briefly summarize your program's strengths, weaknesses, opportunities, and challenges.

Strengths:
1. Student population: One the largest and all <u>entry level</u> Engineering courses fill and the waitlists fill. The engineering courses help drive the advanced Physics and advanced Math courses and vice versa. There exists a steady stream of students that proceed through the Engineering Program to completion and that population is on the rise, slightly, as illustrated by data contained within this report.
2. Student success rates at four year colleges. Sierra College students are notoriously successful at all local four year universities. The Engineering program at Sierra College is rigorous and very hands-on. This has led to an accomplished transfer student that enters the university and finds them self extraordinarily well-prepared. This has earned Sierra College a deserved reputation as an excellent Engineering preparatory school.
3. Top notch instructors, both full time and part time. All instructors care about the students and the material presented during class. They are all outstanding and receive excellent student and faculty reviews. They are committed to the success of the department and the student body.

Weaknesses:
1. FUNDING: The Engineering Department has been underfunded (equipment and consumable budget) for years. This has allowed equipment to fail due to lack of maintenance and impeded current and new lab projects due to lack of new equipment. This must be rectified.
2. Lack of facilities. We simply need more classrooms and lab space. Many more introductory engineering courses could be offered and fill completely if we had the facilities to house them. The department has worked hard to optimize the facilities that we have but no more can be done with the current facilities to increase the number of course offerings. We need new classroom space.

5b) How has the author of this report integrated the views and perspectives of stakeholders in the program?

One word best describes this: Skillfully.