Bakersfield College
Program Review – Annual Update

Attachments (place a checkmark beside the forms listed below that are attached):

- ☒ Faculty Request Form
- ☐ Classified Request Form
- ☐ Budget Change Request Form
- ☐ ISIT Form
- ☐ M & O Form
- ☒ Best Practices Form **(Required)**
- ☐ Other: _____

I. Program Information:

Program Name: Engineering and Engineering Technology

Program Type: ☒ Instructional ☐ Non-Instructional

Program Mission Statement: Engineering and Engineering Technology is an instructional program that strives to offer effective and student centered instruction in the engineering discipline, being sensitive to the diversity of our students, their educational needs, and career goals.

Program Description: Describe how the program supports the mission of Bakersfield College

The Engineering program supports the institutional mission by providing rigorous academic coursework for transfer and relevant technical skills to build employment capacity. Since engineering is a high unit major, students are best served completing the lower division preparation courses at Bakersfield College and continuing in transfer to a four year university, rather than completing the general education required for an A. S. degree. Engineering students who are placed below first semester calculus (~42%) will typically be at the college for more than two years. In such cases, students are encouraged to seek a local degree and develop a skill set through technology coursework, such as AutoCad, SolidWorks, manufacturing, and electronics.

Degrees and Certificates: List the degrees and/or Certificates of Achievement awarded by the program, if applicable.

Engineering Associate of Science Degree
Engineering Technology Associate of Science Degree

II. Program Assessment:

a. How did your outcomes assessment results inform your program planning?

It was identified that technical writing skills among engineering students need to be improved. Faculty plan to offer support services in technical writing skills for students, either through supplemental learning or technical writing workshops. To that end, a STEM Transfer Mentor (CSUB Engineering Student) was recently hired to provide leadership among the Supplemental Learning Program in engineering.

In order to strengthen programming skills, another identified area of weakness, a new robotics platform (Arduino board) was tested with engineering students during Week Zero in August 2013. Since it was a successful project, this robotics platform will be incorporated into the engineering programming course this year.

b. How did your outcomes assessment results inform your resource requests this year?

The Accreditation Board of Engineering and Technology (ABET) has specified that a desired outcome of any engineering curriculum is an emphasis on design. Engineering programs at four year universities seek ABET accreditation to meet state licensure requirements. Thus, most of the engineering courses at Bakersfield College have design project assignments. Assessment of the problem solving skills PLO for the program demonstrated that students perform well on

design projects (> 80% proficiency). Within the scope of such design projects is the development of a product. Thus, the EIT department is developing a Creative Design Center (CDC) that will integrate computer-aided-design, engineering, and other disciplines. Although Industrial Drawing faculty will oversee the CDC, engineering students will have the opportunity to use the CDC equipment to create prototypes of their designs.

Through the STEM grant, Engineering grant, and the Chevron grant, EIT has been able to remodel MS11b (location of the CDC) and add a laser cutter and new 3D printer to the existing 3D printer equipment (these 3D printers use different materials and provide different levels of quality). It is a departmental goal to maintain currency of the technology in the CDC, which may require categorical funds to purchase equipment.

c. Note any significant changes in your program's strengths since last year.

Curricular Changes: As a result of the Solidworks training offered during the 2011-2012 academic year, Industrial Drawing and Manufacturing faculty developed INDR B42, a Solidworks course. This course was approved and offered for the first time during the summer of 2013. This particular course supports welding, manufacturing, industrial drawing and engineering. Use of the Solidworks software was incorporated in the Introduction to Engineering Design and Engineering Statics courses. Two students were hired in internships due to their experience in the Solidworks software. This software will also be the primary platform for the Engineering Graphics course offered in the spring semester of 2014.

Articulation with High Schools: In our ongoing relationship with Project Lead the Way (PLTW), credit by examination to obtain credit for ENGR B47 (Introduction to Engineering and Design) was offered to senior PLTW students at Centennial High School. Three students elected to participate, two of which received credit for the course. This pathway will continue to be developed as more high schools have graduating PLTW students.

Articulation with Universities: CSUB added the following degrees to their existing Computer Engineering program: Electrical Engineering, Engineering Sciences with emphases in Agriculture/Water Resources, Logistics, and Petroleum Engineering. To improve the articulation with CSUB science and engineering disciplines, the dean and STEM counselor met with CSUB administration to propose a more rigorous STEM TAG agreement. It is believed that such a clearly defined pathway for STEM disciplines will result in a higher transfer rates to CSUB.

Student Support Services: MESA, BC Engineers Club, Society of Hispanic Engineers (HOPES), National Society of Black Engineers, and Society of Women Engineers student chapters continue to serve a critical role in providing leadership opportunities for engineering students. In order to provide a broader support base for women seeking STEM careers, the Society of Women Engineers Club was renamed the Women in Science and Engineering (WISE) Club. A very successful Engineering Open House was held for students in the Kern High School District during the spring semester. Two teams of four MESA students each participated in the National Student Solar Spectrograph Competition in May and one of these teams received an award for their leadership in the development of their spectrograph.

Safety: A safety manual was developed for ENGR B45, Properties of Materials. An alarm was installed on the chemical hood in the Engineering Testing Lab and engineering faculty participated in the modification of the Chemical Safety Plan.

d. Note any significant changes in your program's weaknesses since last year.

Curricular: Engineering Technology historically has been a transfer program to four-year universities that provides a reduced engineering theoretical base and an increased technological base (welding, manufacturing, etc.). However, the

CSU system has reduced the Engineering Technology program offerings; encouraging students to pursue Engineering as a major. With the Engineering Model Curricula prepared to be finalized this year, the EIT department will be modifying the Engineering Technology A.S. degree to align with preparation of engineering technicians. Several community colleges across the state have this model curriculum and our industry partners have expressed support for such a degree. Chevron provided grant monies to create a technician pathway for Project Lead the Way students which will begin in the summer of 2014. As a result of these types of initiatives, the department is expanding the automation curriculum, a large component of an engineering technician curriculum. It seems prudent to align the Engineering Technology A.S. degree to the curriculum necessary for employment as an engineering technician. This curricular change should be taking place this year.

e. If applicable, describe any unplanned events that impacted your program.

The only full-time engineering instructor accepted an Interim Dean of Instruction position for 18 months. Thus, the course sections are being covered using adjunct faculty.

III. Technology and Facilities Analysis

a. Has your program received new or repurposed technology in this cycle?

i. If yes, how have you assessed the outcome of the use of that technology and its effectiveness as it relates to student outcomes?

A Mojo 3D printer was purchased and installed in SE-45, the Engineering Testing Lab. This 3D printer was used to produce spinning tops from ABS plastic for the Introductory Engineering classes and a prototype of a hip replacement design developed by students in Engineering Statics. Both of these projects are included in the curriculum to meet the design learning outcomes expected by four-year universities. Each project requires communication of a solution by submission of a technical report, mechanical properties analysis, and/or Powerpoint presentation which is assessed by the instructor. The project grades for these two courses averaged 85% and proved to be critical engagement activities for students.

MS12 is an architectural/industrial drawing lab that was renovated using funds from the Engineering grant. Britelinks technology was added along with multiuse drawing stations. Although this is not an engineering lab, it is used by engineering support courses.

ii. If no, what technology could play a contributing factor in future student success and outcomes for your program? How would you evaluate the use of this technology?

iii. How might other areas use this technology?

3D printing is cutting edge technology that can be used to construct models in a variety of disciplines: mathematics, geology, biology, anthropology, art, etc.

Britelinks is a fairly inexpensive projector/software that operates similar to SmartBoards. This technology allows for interaction with the software on the projected surface. It provides a teaching pedagogy that would be transferrable to almost any other discipline.

(NOTE: Technology requests can be made by filling out the ISIT Request form.)

b. Has your area received any facilities maintenance, repair or updating in this cycle? If yes, how has the outcome contributed to student success?

The remodel of MS11b should be completed by the end of September. Student success outcomes will be assessed in this academic year.

(NOTE: Facilities and M&O requests can be submitted by completing the M&O request form)

IV. Trend Data Analysis:

Discuss any significant changes in data trends over the last year using data provided by Institutional Research. Metrics may include the following:

a. Changes in student demographics (gender, age and ethnicity)

Age and gender distributions in engineering have remained consistently similar over the last 5 years. However, the percentage of Hispanics enrolled in engineering courses has increased 8% over the last five years, now comparable to the 56% Hispanic enrollment collegewide. Although there has been an overall college initiative to increase the number of students declaring a major, it is interesting to note that there was a 44% increase in the number of Hispanic students declaring engineering as a major from Fall, 2010 to Fall, 2012. During this time frame there was also a 38% increase in the number of Hispanic Freshmen students ($\leq$ 24 units) declaring engineering as a major. (Data provided through data tracking in the STEM grant.)

b. Changes in enrollment (headcount, sections, course enrollment and productivity)

Enrollment has remained stable due to the number of limited sections offered in the engineering program. Over the last five years, FTES have slightly decreased by about 2%, but productivity has increased slightly by 0.8%.

c. Success and retention for face-to-face, as well as online/distance courses

Over the last 5 years, retention rates have remained fairly constant averaging between 83% and 91%. During 2012-2013 the retention rate was 86.4% which was slightly higher than the collegewide retention rate of 85.9% (only face-to-face). Success rates have also remained fairly constant averaging between 74% and 81%. During 2012-2013 the success rate was 73%, higher than the collegewide success rate of 69.1% (only face-to-face). Most engineering courses can be very challenging and a retention rate of 86.4% and success rate of 73.0% are positive indicators of a strong program.

d. Degrees and certificates awarded (five-year trend data for each degree and/or certificate awarded)

Engineering is a high-unit transfer program in which pursuing an A.S. degree is typically discouraged. Likewise, the current Engineering Technology program is a similar transfer program with additional industrial technology courses required. As a result of the transfer emphasis, very few degrees were awarded over the last 5 years (6 A.S. degrees total).

e. Other program-specific data *(please specify or attach)*

Transfer data is still not available and is the most important metric to describe the success of an engineering program. The 2010 CPEC data indicated 28 transfers in engineering. This data does not include CSUB, private or out of state schools.

V. Progress on Program Goals:

List the program's goals from the previous Program Review. For each goal, please discuss progress and changes. If the program is addressing more than two (2) goals, please duplicate this section.

Previously Established Goal 1: *(state goal)*
Continue to integrate robotics in the engineering curriculum and align the engineering curriculum with the C-IDs and MC once vetted.

Progress on Goal: The C-IDs and the Model Curricula for Engineering are vetted, but not finalized. Engineering faculty are already in the process of developing aligned course updates to submit in Curricunet upon finalization of the C-IDs and MC.

☐ Completed: _____ (Date) ☒ **Revised**: __9/23/2013_____ (Date)

Comments on Goal 1: During the 2013-2014 academic year, engineering faculty will submit updated curriculum to align with the C-IDs and the Model Curricula once these are finalized at the state level.

Previously Established Goal 2: *(state goal)*
Establish a Creative Design Center and develop a cohort program with basic skills to engage students in technological skills.

Progress on Goal: The Creative Design Center is almost completed and discussions with administration concerning a possible cohort program will take place this coming academic year.

☐ Completed: _____ (Date) ☒ Revised: ____9/23/2013_____ (Date)

Comments on Goal 2:

Previously Established Goal 3: *(state goal)*
Continue to address the gaps in core indicators, particularly the gap in female enrollment.

Progress on Goal: In an effort to provide a broader support base for women seeking STEM careers (including engineering), the Society of Women Engineers Club was renamed the Women in Science and Engineering (WISE) Club.

☐ Completed: _____ (Date) ☒ **Revised**: __9/23/2013_____ (Date)

Comments on Goal 3: The progress on this goal simply is not enough. The faculty are investigating webinars on female recruitment in STEM disciplines.

VI. Curricular Review (Instructional Programs only):

a. List each of the courses offered within the discipline's academic program in the first column, using one row per course. Place an **X** in the appropriate column to indicate when the course is scheduled for review.

Course	2013-2014 (2019-2020)	2014-2015 (2020-2021)	2015-2016 (2021-2022)	2016-2017 (2022-2023)	2017-2018 (2023-2024)	2018-2019 (2024-2025)
Engr B17					X	
Engr B17L				X		
Engr B19c/c++	X					
Engr B24					X	
Engr B36				X		
Engr B37					X	
Engr B40			X			
Engr B45					X	
Engr B47						X

b. List courses that are proposed for *addition*. **ENGR B38**, Strength of Materials; **ENGR B19M**, MATLAB for Engineers and Scientists.

c. List courses that are proposed for *deletion*. **ENGR B41, ENGR B60**

d. List any changes the program has made to online/hybrid/distance education courses.

No changes have been made, but faculty plan to convert Engr B47 (Introduction to Engineering and Design) to a hybrid course.

e. Provide an update on the program's transition to adopting a Transfer Model Curriculum (AA-T or AS-T), if applicable.

The Engineering Model Curricula (Electrical/Computer Engineering and Mechanical/Civil/Aerospace/Manufacturing Engineering) are vetted and awaiting final approval. Once final approval is granted, the engineering program will align our local A.S. degree with these model curricula. The Engineering Model Curricula will not result in an AS-T degree due to the high number of units required for an engineering B.S. degree. Courses will be aligned with the C-IDs and It is expected that ENGR B17, 17L, 36, 37, and 40 will be in alignment in their current state. However, major changes will need to be made to ENGR B19c/c++, ENGR B24, ENGR B45, and ENGR B47.

VII. Conclusions and Findings:

Present any conclusions and findings about the program.

The Engineering Program is celebrating its 81st year at Bakersfield College and has a long established record of success. Opportunities for positive community impact abound with this program: a clearly defined engineering pathway through the implementation of course C-IDs and the Model Curricula; newly formed engineering degree programs at CSUB providing increased accessibility for local engineering transfer education; STEM grant funding to support programmatic improvements and expansion; integration of new technologies; and continued industry support.