

INSTITUTIONAL PROGRAM REVIEW 2015 – 2016
Program Efficacy Phase: Instruction
DUE: March 30, 2016

Purpose of Institutional Program Review: Welcome to the Program Efficacy phase of the San Bernardino Valley College Program Review process. Program Review is a systematic process for evaluating programs and services annually. The major goal of the Program Review Committee is to evaluate the effectiveness of programs and to make informed decisions about budget and other campus priorities.

For regular programmatic assessment on campus, the Program Review Committee examines and evaluates the resource needs and effectiveness of all instructional and service areas. These review processes occur on one-, two-, and four-year cycles as determined by the District, College, and other regulatory agencies. Program review is conducted by authorization of the SBVC Academic Senate.

The purpose of Program Review is to:

- Provide a full examination of how effectively programs and services are meeting departmental, divisional, and institutional goals
- Aid in short-range planning and decision-making
- Improve performance, services, and programs
- Contribute to long-range planning
- Contribute information and recommendations to other college processes, as appropriate
- Serve as the campus' conduit for decision-making by forwarding information to appropriate committees

Our Program Review process includes an annual campus-wide needs assessment each fall and an in-depth efficacy review each spring of each program on a four-year cycle. All programs are now required to update their Educational Master Plan (EMP) narrative each fall. In addition, CTE programs have a mid-cycle update (2 years after full efficacy) in order to comply with Title 5 regulations.

Two or three committee members will be meeting with you to carefully review and discuss your document. You will receive detailed feedback regarding the degree to which your program is perceived to meet institutional goals. The rubric that the team will use to evaluate your program is embedded in the form. As you are writing your program evaluation, feel free to contact the efficacy team assigned to review your document or your division representatives for feedback and input.

Draft forms should be written early so that your review team can work with you at the small-group workshops (March 4 and March 25, 2016). Final documents are due to the Committee co-chair(s) by **Wednesday, March 30** at midnight.

It is the writer's responsibility to be sure the Committee receives the forms on time.

The efficacy process incorporates the EMP sheet, a curriculum report, SLO/SAO documentation. We have inserted the curriculum report for you. We have also inserted the dialogue from the committee where your last efficacy document did not meet the rubric. SBVC's demographic data will be available on or before February 26. Below are additional links to data that may assist you in completing your document:

California Community College Chancellor's Office Datamart: <http://datamart.cccco.edu/>

SBVC Research, Planning & Institutional Effectiveness:
<http://www.valleycollege.edu/about-sbvc/offices/office-research-planning>

California Community Colleges Student Success Scorecard:
<http://scorecard.cccco.edu/scorecard.aspx>

Program Efficacy

2015 – 2016

Complete this cover sheet as the first page of your report.

Program Being Evaluated

Physics/Astronomy/Observatory

Name of Division

Science

Name of Person Preparing this Report

Michael Lysak

Extension

X-8529

Names of Department Members Consulted

Anna Tolstova, Chris Clarke, Pat Jenkins

Names of Reviewers (names will be sent to you after the committee meets on February 19)

Paula Milligan, Anna Tolstova, Sandra Moore

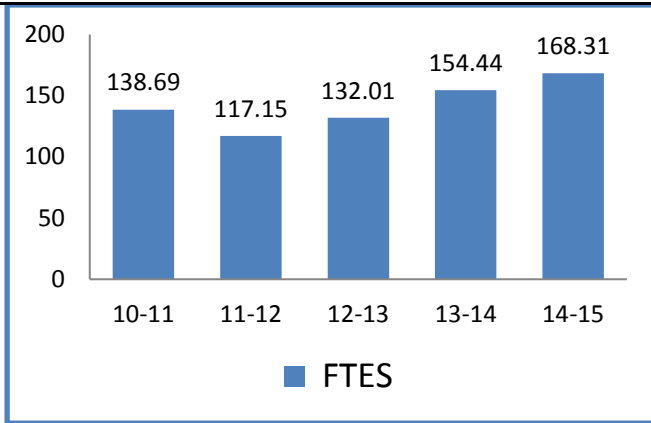
Work Flow	Date Submitted
Initial meeting with department	3/4/16
Meeting with Program Review Team	3/24/16 (A. Tolstova)
Report submitted to Program Review co-chair(s) & Dean	by midnight on March 30, 2016

Staffing

List the number of full and part-time employees in your area.

Classification	Number Full-Time	Number Part-time, Contract	Number adjunct, short-term, hourly
Managers	1 (Science Dean)	0	0
Faculty	2 (3*) *SBVC faculty from Applied Technology teaches Engineering	0	4
Classified Staff	1	1	0
Total	4 (5*)	1	4

PROGRAM: INSERT YOUR RECENT EMP FROM FALL 2015

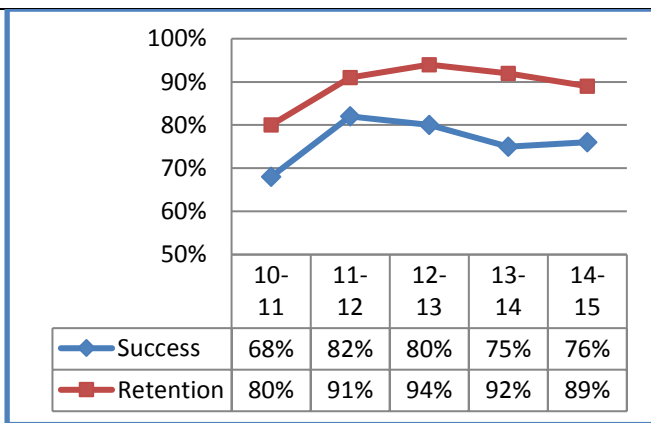


Description: The Physics/Astronomy/Engineering Department offers general education Physics/Astronomy courses; a physics sequence for majors in the life sciences, biology, pre-nursing/medicine, and allied health programs; a physics sequence for majors in astronomy, chemistry, engineering, geology, physics, and other physical sciences; and engineering courses. The department operates a Planetarium and an Observatory supporting instruction and offering Astronomy programs for local schools and community.

	10-11	11-12	12-13	13-14	14-15
Duplicated Enrollment	814	604	656	771	797
FTEF	6.08	5.95	6.29	7.20	8.42
WSCH per FTEF	684	591	630	643	599

Assessment:

- FTES, enrollment, and WSCH/FTEF increased steadily, on average, through 13-14 since the slight drop in 11-12 resulting from section cutbacks and budget restrictions
- Retention rates generally increased and leveled off through 13-14; success rates dropped slightly from 11-12 to 13-14
- With new sections opening, FTES, enrollment, and WSCH/FTEF have increased in 13-14 after dropping significantly in 11-12 due to cutbacks
- Number of degrees awarded has remained fairly constant, but with a slight, steadily increase since 10-11



Department Goals:

- Create more tutoring/workshop opportunities for Department students through the Student Success Center and the SI Program
- Strengthen/build the Engineering program and offer more Engineering courses
- Offer Physics 101 as a hybrid course, with online lectures and on-campus labs and/or tests
- Maintain lab equipment and supplies for quality education
- Update the Physics/Astronomy labs and their related equipment needs
- Incorporate the use of on-line practice problem-solving software as Mastering Physics or Web-Assign in upper level courses

Challenges & Opportunities:

- Develop strategies to increase retention and student success rates
- Develop strategies to increase the productivity of classes determined by WSCH/FTEF
- Develop ways to encourage more students to major in the physical sciences to increase the number of degrees awarded
- Enhance the Department's curriculum with more engineering-related offerings and encourage more pre-engineering students to attend SBVC
- Encourage more pre-med students to attend SBVC

	10-11	11-12	12-13	13-14	14-15
Sections	36	26	27	33	38
% of online enrollment	6%	8%	7%	6%	5%
Degrees awarded	0	2	1	4	1
Certificates awarded	N/A	N/A	N/A	N/A	N/A

TOP Code: 191100/190200
Award Source:
http://datamart.cccco.edu/Outcomes/Program_Awards.aspx

- Action Plan:**
- Consult other on-line instructors to formulate a hybrid Physics course
 - Update/revise the Physics/Astronomy labs and related equipment with Department lab technician
 - Work with local universities to enhance the Department curriculum with more engineering courses and to encourage more pre-engineering and pre-med students to attend SBVC
 - Incorporate and support the operation of the SI program in all Physics, Astronomy, and Engineering courses
 - Test existing practice problem-solving software and consult with other colleges using such software to determine the most appropriate software for use at SBVC

Part I: Questions Related to Strategic Initiative: Access

Use the demographic data provided to describe how well you are providing access to your program by answering the questions below.

Strategic Initiative	Institutional Expectations	
	Does Not Meet	Meets
Part I: Access		
Demographics	The program does not provide an appropriate analysis regarding identified differences in the program's population compared to that of the general population	The program provides an <u>analysis</u> of the demographic data and provides an interpretation in response to any identified variance. If warranted, discuss the plans or activities that are in place to recruit and retain underserved populations.
Pattern of Service	The program's pattern of service is not related to the needs of students.	The program provides <u>evidence</u> that the pattern of service or instruction meets student needs. If warranted, plans or activities are in place to meet a broader range of needs.

INSERT DEMOGRAPHIC DATA (PROGRAM & CAMPUS) Program Review Committee will provide this on or before February 26.

Demographics - Academic Years - 2012-13 to 2014-15		
Demographic Measure	Program: Physics/Astronomy	Campus-wide
Asian	8.5%	4.9%
African-American	8.0%	13.4%
Hispanic	56.9%	61.8%
Native American	0.9%	0.3%
Pacific Islander	0.6%	0.4%
White	12.5%	15.4%
Unknown	12.6%	0.6%
Female	47.8%	55.1%

Male	52.2%	44.7%
Disability	2.8%	5.6%
Age Min:	15	15
Age Max:	76	83
Age Mean:	26	27

Does the program population reflect the college's population? Is this an issue of concern? If not, why not? If so, what steps are you taking to address the issue?

The Physics/Astronomy program's demographics are quite similar to the college's demographics (to within 4 %) but with some small differences. With respect to gender, the program is slightly more disproportionate toward men than the college overall. This is perhaps reflective of the requirement of Physics for students planning to enter the field of engineering which has been traditionally a male-dominated field. We are not actively attempting to address this disparity on a large scale as it is a reflection of a much larger historical trend in engineering and the physical sciences. However, the department has participated in the annual Science Division-sponsored Science Day and has made several presentations, through the Planetarium program, for organizations as the Girl Scouts, where both activities have the potential to strongly encourage and inspire both women and men to pursue careers in the physical sciences; further, we have supported and encouraged our female and male students to participate in Student Success Center-sponsored activities as "Celebrating Women in Science and Math Day", "Women in Math and Science", and "STEMPALOOZA" for the past few years; further, our other Physics full-time faculty has not only done several workshops for middle and elementary schools where young girls and boys are encouraged to enter the physical sciences, but she is also an advisor of the STEM club at SBVC which has many female members. Finally, we strongly encourage women as well as men to enroll in our program, and we do provide information about all career options available in all levels of our Physics/Astronomy classes.

Another disparity in the data is in the level of service for African-Americans and Hispanics. Nearly all of the Physics classes have a mathematics pre-requisite equal to or nearly equal to the graduation requirement. The pre-requisite for Physics 101 is Math 090, Elementary Algebra. The prerequisite for Physics 150AB and above is Math 103, Plane Trigonometry. Basic skills data informs us that African-Americans and Hispanics, particularly men, are less likely to be successful in basic skills acquisition than the rest of the demographic profiles served by the institution. Our numbers are dependent upon the successful completions in the pre-requisite mathematics courses. Therefore, it is perhaps the classes in the program that have pre-requisites that brings our demographic data overall below the campus average.

To address issues of student success and basic skills preparation, the Physics/Astronomy department, in concert with the Math Division as well as with all the other departments within the Science Division, has actively supported the Student Success Center. The Physics/Astronomy department is in full support of the services provided by the Student Success Center, and the department presently has several students working there as Physics tutors and SI leaders; further, the Student Success Center is a tremendous aid in helping students with basic skills mathematics preparation. Such academic assistance and preparation by the Student Success Center at the basic skills level in both Physics and Mathematics, together with additional assistance provided by the Center at the more advanced levels of these disciplines, significantly contribute to ensuring that more under-represented groups as African-Americans, Hispanics, and women will enroll and be successful in the Physics/Astronomy program.

Finally, in light of the past-awarded Science, Technology, Engineering and Mathematics (STEM) grant, it is hoped that communities as African-Americans, Hispanics and women, who seem to be under-represented in the Physics/Astronomy program, will have the opportunity to enroll and succeed in more of the sciences and mathematics, and that the demographics will shift in the future accordingly.

Pattern of Service

How does the pattern of service and/or instruction provided by your department serve the needs of the community? Include, as appropriate, hours of operation/pattern of scheduling, alternate delivery methods, weekend instruction/service.

The Physics/Astronomy department determines its schedule by analyzing the number of sections offered in the past and the percentage fill, and weighing that against the number of laboratories that could

be offered with limited laboratory space. We also consider, by collaboration with other departments, what major's classes need to be offered such that student progress is continuous each semester. Then a proposed schedule is produced that will potentially fill to 80%, per the direction of the Instruction Office, before any faculty are assigned to any section. We then examine what time-blocks or innovative offering schedules might serve student needs and where they may fit into our schedule.

With only two full-time faculty, our ability to offer many sections over the many different time slots is limited. Also, in order to keep Physics 150AB as a viable class, with more recent low enrollments in this class over the past few years, we have retained the combined sections of both Physics 150AB and Physics 200/201 as one lecture, but with separate and staggered problem-solving lab structures, and with different requirements with regard to testing and lab experiments. However, more recently, interest in engineering has shown an upsurge, and this is reflected in the larger enrollments with long waiting lists in the engineering-based Physics 200/201/210 classes, in the Introductory Physics 101 classes, and in the Astronomy classes. In response to this, we are offering more night sections of Physics 101, more sections of Astronomy lecture and lab, and we have expanded our offerings for Physics 150AB and Physics 200/201 to include day and evening lecture and lab sections as well as sections of Physics 150A/200 that are offered in Spring as well as Fall. Presently, we offer Physics 101 during Fall, Spring and Summer, Astronomy classes during Fall and Spring, Physics 200/150A and Physics 150B/201 in both Fall and Spring, and Physics 210 in the Summer. The Astronomy lectures are offered all week, with both day and evening sections, with the Astronomy labs presently having two afternoon offerings; the Physics 101 and the Physics 150A/200 and Physics 150B/201 classes are offered all week, in the mornings and evenings, with labs from late morning to late afternoon, and Physics 101 also has two or three evening lecture/lab sections in Fall and Spring. Presently, to try to give the students as much flexibility as possible in scheduling their courses, the Physics 101 students in the MW or TTh morning lectures are able to enroll in either the respective M or W labs/T or Th labs, and the Physics 150AB/Physics 200/201 students are able to enroll in either the M or W lab sections, or, for the evening Physics 150AB/Physics 200/201 class, enroll in either the Tuesday afternoon or Tuesday evening labs; further, the Physics 101 MW and TTh lecture class' lab and the Physics 150AB/Physics 200/201 M labs are offered in nearly adjacent lab rooms, which exposes the introductory students to more advanced lab work to generate interest in future coursework in Physics. For the past few years, recent interest in Physics and engineering has allowed us to successfully offer Modern Physics 210 in the Summer session as well as offering Engineering Statics 265 in the Spring; however, enrollments in both these courses has been traditionally low, and the Department is working to find effective ways of increasing the interest and enrollments in each of these classes.

The Physics/Astronomy department offers an Astronomy Hybrid course, in which the students view an on-line-streamed Astronomy video telecourse, and where the students have an opportunity to enroll in one of the two Astronomy labs sections that are offered. The department is considering re-offering Physics 101 on-line as it had done in the past, but with requiring its students to attend the Physics labs once weekly; the department does not believe it is pedagogically sound or feasible to offer laboratory instruction on-line. The Astronomy Hybrid course meets on Saturdays several times a semester to have the students discuss the related material, to answer questions, and to take the mid-semester tests and exams. On occasion, the Planetarium specialist is asked to present to these classes brief Astronomy-related shows. The Planetarium offers presentations for the public about two times a month, on Fridays; this is not only available as a valuable service for our students, but as a most valuable outreach and public relations vehicle for the Physics/Astronomy department and for the College, in general. The Planetarium presentations can foster new or continuing interest not only in the sciences, but in furthering one's education as well.

Part II: Questions Related to Strategic Initiative: Student Success

Strategic Initiative	Institutional Expectations	
	Does Not Meet	Meets
Part II: Student Success – Rubric		
Data/analysis demonstrating achievement of instructional or service success	Program does not provide an adequate <u>analysis</u> of the data provided with respect to relevant program data.	Program provides an <u>analysis</u> of the data which indicates progress on departmental goals. If applicable, supplemental data is analyzed.
Student Learning Outcomes (SLOs)	Program has not demonstrated that they are continuously assessing Student Learning Outcomes (SLOs) based on the plans of the program since their last program efficacy. Evidence of data collection, evaluation, and reflection/feedback, and/or connection to student learning is missing or incomplete.	Program has demonstrated that they are continuously assessing Student Learning Outcomes (SLOs) based on the plans of the program since their last program efficacy. Evidence of data collection, evaluation, and reflection/feedback, and connection to student learning is complete.

Provide an analysis of the data and narrative from the program's EMP Summary and discuss what it reveals about your program. (Use data from the Charts 3 & 4 that address Success & Retention and Degrees and Certificates Awarded")

According to the census data, the number of students listed as duplicated enrollment has grown significantly from an average of 604 students (2011-2012 academic year) to 797 (2014-2015), an increase overall of nearly 32%; this trend had been strongly influenced by the faltering economy, and by other local four-year institutions and universities decreasing their enrollments.

As we have only recently (Fall 2015) increased our full-time faculty to two since the Fall of 2002 with the retirement of the previous department chair, we expected our success rates and retention rates to remain relatively constant, and they have. While, semester to semester, the retention and success rate varies as we turn over our numbers of part-time faculty, overall the rate has been fairly consistent. This is evidenced by calculating the slope of the best-fit line to the data: the resulting slope is nearly equal to zero, (success rate: absolute slope of 0.900% per academic year; retention rate: absolute slope of 1.90% per academic year; all data from the 2010-11 through the 2014-15 academic years). Since Fall of 2010, the Physics/Astronomy retention rate average is 89.2% and the success rate is 76.2%; it may seem contradictory to be satisfied with a consistent rate for retention and success, but, given the turn-over in adjunct faculty, the reduction of full time faculty to one for this time period, and having our full-time Physics laboratory technician who retired at the end of 2005 being replaced only by half-time lab assistance, we are pleased that a drop in retention and success did not occur. Additionally, for the students who participate in activities provided by the Student Success Center such as tutoring, SI workshops, and help through course facilitators, the general retention and success rates tend to be significantly higher.

In response to the other data solicited, although the number of sections offered has increased by 46% from the academic years of 2010-11 through 2014-15, the number of degrees awarded has not changed much at all; over these past four years, the average number of degrees awarded has been two; further, we do not track the number of degrees or transfers empirically, but assume all students completing the Physics 150AB sequence, or the Physics 200/201/210 sequence will transfer; approximately 5-10 students transfer per semester. This low average degree number is also misleading as many students transfer during every point in the course of major's preparation for a variety of reasons. Students also choose to transfer uncertified, meaning they have completed their lower division major's preparation but not their general education requirements, without earning a degree. The nature of the traditional four-year education plan for a science major requires a large number of units on major's preparation during the first two years, and much fewer major's units during the last two years of a Bachelor's degree program. It is typical at four-year institutions for junior and senior status science majors to be enrolled in several general education classes to complete breadth requirements.

Supplemental Data

Provide any additional information, such as job market indicators, standards in the field or licensure rates that would help the committee to better understand how your program contributes to the success of your students.

There is a national concern that there are too few physical sciences and engineering majors at the baccalaureate and graduate levels.

Most professional schools, for example, medical schools, have a recency requirement for applicants such that they have successfully completed their science classes within the last five years. Some of our students are returning students working to meet these requirements.

According to the labor market information obtained from the website www.labormarketinfo.edd.ca.gov, the following are some sample projected growth rates for jobs in California, for 2012-2022, in the following fields: Biomedical Engineer, 42.6%; Biochemists and Biophysicists, 27.0%; Physician assistants, 33.7%; Registered Nurses, 16.9%; Post-secondary Physics Instructors, 15.4%; Geoscientists, 22.4%; Physicists, 18.4%; Environmental Engineer, 24.7%; Civil Engineers, 18.3%; Physical Scientists, 20.7%; Nuclear Engineers, 20.0%; Aerospace Engineers, 18.5%. Further, Clearly there is a strong demand for physics instructors, engineers, and other professions which need Physics as part of the core course requirements for students entering such fields in the physical sciences and the health professions, and the Physics/Astronomy program provides these core requirements.

Student Learning Outcomes

Course SLOs. Demonstrate that your program is continuously assessing Course Student Learning Outcomes (SLOs), based on the plans of the program since the last efficacy review. Include evidence of data collection, evaluation, and reflection/feedback, and describe how the SLOs are being used to improve student learning (e.g., faculty discussions, SLO revisions, assessments, etc.). Generate reports from the SLO Cloud as necessary. Include analysis of SLO Cloud reports and data from 3-year summary reports. This section is required for all programs.

See [Strategic Goal 2.11](#)

Every semester, the Physics/Astronomy program has collected data in each of our Physics and Astronomy courses, in both lecture and lab sections, and for all the sections of each course as well, for the purpose of examining student learning outcomes (SLOs) in each course. This data is then analyzed, and the results are used to develop strategies for improving instruction, to consider ways of possibly needing to alter the method of testing that determine whether or not the student learning outcomes have been adequately met, or to perhaps evaluate the student learning outcomes themselves and see if they need to be modified.

For the past several years, the program has assessed all of our active courses: Physics 101, Physics 200, Physics 150A, Physics 201, Physics 150B, Physics 210, Astronomy 120, Astronomy 125, and Engineering 265, and we have done so for all sections of each course, taught by both the full-time and adjunct faculty. We are beginning the third cycle of the SLO evaluation, and plan to use the data collected in the first two evaluation cycles to help improve instruction and/or alter the testing methods or the SLOs themselves, as outlined above.

The courses Astronomy 222 and Physics 222 are guided, independent study courses whose SLOs have not been assessed; for the several years, there has been no student interest/enrollment in these courses, and hence no means for the department to evaluate any student learning outcomes. Also, Physics 010, a CR/NC course designed to offer workshops to develop and strengthen basic skills needed to succeed in physics and other science courses, has never been offered, and never assessed.

The following are *excerpts* (in italics) from the SLO Cloud for what was done in each of our courses and the percentage of sections reporting (not to include SP2016):

(after each SLO, will be listed (# of Students Assessed, % of Students who Met SLO))

Course: **Physics 101**

1. Students will demonstrate an understanding of basic, physical concepts by correctly describing and identifying these concepts. (709, 90.97 %)
2. Given new situations, by applying the basic scientific principles, students will correctly solve simple problems by the application of the concepts of physics. (702, 90.17%)
3. Also, given a particular laboratory physical objective, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems. (709, 91.4%)

Assessment Method: ...*For SLO #3, a percentage of how many students had lab report averages falling within similar ranges was taken to represent the students' ability to assemble, use, and analyze physical systems...*

Reflection: ...*Students seemed to generally have more difficulty in the application of physical law to solve various problems, as opposed to just being able to identify and describe these physical concepts and phenomena...*

Reporting: 75%

Course: **Physics 150A**

1. Students will demonstrate an understanding of the basics of the fields of mechanics, fluids, oscillatory motion, thermodynamics, and their corresponding physical laws by correctly describing and identifying the concepts relevant to these fields. (121, 80.99%)

2. Given new situations, by using various trigonometric and algebraic techniques with some discussion of relevant calculus concepts, students will correctly solve a variety of physical situations by a proper application of the principles, laws, and concepts of physics. (121, 80.17%)

3. Also, given a particular laboratory physical objective in mechanics, fluids, oscillatory motion, or thermodynamics, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems. (121, 88.43%)

Assessment Method: ...*For SLO #1 and SLO #2, for each of the four semester tests that were taken, a percentage of how many students scored within the ranges 100%-85%, 85%-70%, 70%-55%, 55%-45%, and 45%-0 was calculated to represent the students' ability to not only understand the basic concepts, but also to be able to solve a variety of physical situations...*

Reflection: ...*Students seemed to do well in the tests relating to basic motion, but as the concepts became more difficult, as in vector forces, momentum, energy, and rotation, the percentages dropped...*

Reporting: 92.3%

Course: **Physics 150B**

1. Students will demonstrate an understanding of the basics of the fields of electricity, magnetism, wave mechanics, optics, and modern physics, and their corresponding physical laws by correctly describing and identifying the concepts relevant to these fields. (59, 91.53%)

2. Given new situations, by using various trigonometric and algebraic techniques with some discussion of relevant calculus concepts students will correctly solve a variety of physical situations by a proper application of the principles, laws, and concepts of physics. (59, 91.53%)

3. Also, given a particular laboratory physical objective in electricity, magnetism, wave mechanics, optics, or modern physics, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems. (59, 93.22%)

Assessment Method: ...*"Good Enough": A percentage between 55% and 70% for both the test averages and the lab report/lab notebook averages...*

Reflection: ...*Since lab reports are not test situations, students generally have ample opportunity (usually one to two weeks) to complete their reports and/or lab notebooks...*

Reporting: 100%

Course: **Physics 200**

1. Students will demonstrate an understanding of the basics of the fields of mechanics, fluids, oscillatory motion, thermodynamics, and their corresponding physical laws by correctly

describing and identifying the concepts relevant to these fields. (307, 84.69%)

2. Given new situations, by using various calculus, trigonometric, and algebraic techniques students will correctly solve a variety of physical situations by a proper application of the principles, laws, and concepts of physics. 299, 82.94%)

3. Also, given a particular laboratory physical objective in mechanics, fluids, oscillatory motion, or thermodynamics, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems.
(303, 88.12%)

Assessment Method: ...how many students scored within the grade ranges 100%-85%, 85%-70%, 70%-55%, 55%-45%, and 45%-0 was calculated to represent the students' ability to not only understand the basic concepts, but also to be able to solve a variety of physical situations...

Reflection: ...few students have experience in this field, which can, at times, tend to be abstract; when the topics related to fluids and simple harmonic motion though, the percentages were higher, perhaps since the topics were new, required less synthesis...

Reporting: 100%

Course: Physics 201

1. Students will demonstrate an understanding of the basics of the fields of electricity, magnetism, wave mechanics, optics, and modern physics, and their corresponding physical laws by correctly describing and identifying the concepts relevant to these fields. (161, 92.55%)

2. Given new situations, by using various calculus, trigonometric, and algebraic techniques, students will correctly solve a variety of physical situations by a proper application of the principles, laws, and concepts of physics. (161, 94.41%)

3. Also, given a particular laboratory physical objective in electricity, magnetism, wave mechanics, optics, or modern physics, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems. (161, 96.27%)

Assessment Method: ...a percentage of how many students had lab report averages falling within the same grade ranges was taken to represent the students' ability to assemble, use, and analyze physical systems. "Good Enough": A percentage between 55% and 70% ...

Reflection: ... The formation of small study groups in the classroom and/or in the lab environments and/or in the student success center would encourage collaborative learning reinforcement of basic physical concepts and of problem-solving skills...

Reporting: 100%

Course: Physics 210

1. Students will demonstrate an understanding of the basics of modern physics, to include the topics of relativity, quantum mechanics, atoms, molecules, condensed matter, nuclear physics, particle physics, and their corresponding physical laws by correctly describing and identifying the concepts relevant to these fields. (11, 100%)

2. Given new situations, by using various calculus, trigonometric, and algebraic techniques students will correctly solve a variety of physical situations by a proper application of the

principles, laws, and concepts of physics. (11, 100%)

3. Also, given a particular laboratory physical objective in modern physics, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems; or, given data from internet-based investigations or computer simulations of physical systems or situations in modern physics, students will correctly analyze measurements of these physical systems. (11, 100%)

Assessment Method: ... Four semester tests were taken, and modern physics problems were assigned daily and discussed during the problem-solving lab sessions in this four week summer class; a percentage of how many students scored within the ranges 100%-85%, 85%-70%, 70%-55%, 55%-45%, and 45%-0 was calculated to represent the students' ability to not only understand the basic concepts, but also to be able to solve a variety of physical situations in modern physics...

Reflection: ... So the higher performance of the students when covering the more familiar physics balanced the lower performance they demonstrated when studying more difficult modern physics topics...

Reporting: 100%

Course: Astronomy 120

1. Students will demonstrate an understanding of basic, astronomical concepts and phenomenology, and of their related physical concepts, by correctly describing and identifying these concepts and phenomena. (186, 87.10%)

2. Given a particular astronomical scenario, by applying the basic scientific principles students will correctly describe the outcomes of these scenarios by the proper application of the concepts of physical law and astronomy. (186, 87.10%)

3. Students will demonstrate an understanding of the apparent motions of celestial objects in the night sky by correctly describing and identifying these motions. (186, 87.10%)

Assessment Method: ... was calculated both for the final exam and for the overall course grade; since the final exam is comprehensive, it is a better assessment of the overall student course performance than any one of the individual semester tests; the performance on the final should reflect the students' understanding of basic, astronomical concepts and phenomenology...

Reflection: ... wrote a brand new final with 100 questions worth 2 points each. I did allow for a 10% curve due to possible misunderstood questions. Amazingly so, the percentage of students meeting the "Good Enough" standard in this Hybrid was the same as in the traditional class ...

Reporting: 63.6%

Course: Astronomy 125

1. Given a particular laboratory astronomical and/or physical objective, students will correctly construct physical systems, learn to use and manipulate laboratory apparatus, and correctly make and analyze measurements of these physical systems. (36, 52.78%)

2. Given data from internet-based investigations, computer simulations, or previously-performed investigations in astronomical and/or physical systems, students will correctly analyze measurements of these systems. (36, 52.78%)

3. Students will become familiar with the basic principles and operation of various

astronomical instruments by hands-on laboratory experience. (36, 52.78%)

Assessment Method: ... the angle subtended by the Moon is measured with the cross staff, the lunar diameter is estimated by counting the number of large lunar craters it takes to cross the surface, estimating the crater size from a large impact crater on the Earth. From that, calculate the distance to the Moon That works surprisingly well ...

Reflection: ... Some labs require computation using unit conversion. This can be annoying, error prone, and no long term advantage to most of the students. I will in the future provide a table so conversions can be read off. That way student's time can be spent in understanding what has gone on. ...

Reporting: 33.3%

Course: **Engineering 265**

1. The students will be able to describe motion, forces and moments in terms of two and three dimensional vectors. (2, 100%)
2. The students will be able to determine the resultant when given a system of forces. (2, 100%)
3. Write shear and bending-moment equations, and draw shear and bending-moment diagrams for beams loaded with concentrated and/or uniformly distributed loads. (2, 100%)

Assessment Method: ... final exam (ENGR-265-01 for 2014SP)

Reflection: ... SLO 1: We spent quite a bit of time in class going over how to do vector math in 2D and 3D. I met with each student individually as they were doing problems to make sure that they know how to do this...

Reporting: 50%

The average reporting rate for the Physics classes was 94.6%; the average reporting rate for the Astronomy classes was 58.2%; the bulk of our majors classes in Physics is taught by full-time faculty; our Astronomy classes are presently taught only by adjunct faculty; until recently, our Engineering class had been taught by adjunct faculty; it seems that full-time faculty are more responsible in attending to the reporting of SLO data, and the high percentages reflect this; the department will more vigorously strive to encourage adjunct faculty to report SLO data for all the sections they teach, every semester. Also, classes like Modern Physics and Engineering historically have tended to be very low enrolled, so percentages of students completing the SLOs are higher than in the courses like Physics 101, Physics 150AB or Physics 200/201 where the enrollments are high; further, only recently faculty have been reporting SLO data via the Cloud, and since this is the first three-year assessment using the Cloud-accumulated data, numbers/statistics may be relatively weak and/or misleading for lack of data. The next three-year assessment should yield more significant results.

Program Level Outcomes: If your program offers a degree or certificate, describe how the program level outcomes are being used to improve student learning at the program level (e.g., faculty discussions, SLO revisions, assessments, etc.). Discuss how this set of data is being evaluated or is planned to be evaluated. Generate reports from the SLO Cloud as necessary. Include analysis of SLO Cloud reports and data from 3-year summary reports. If your program does not offer a degree or certificate, this section is optional (but encouraged).

(INSERT COURSE MAP IF AVAILABLE)—Contact Dr. Celia Huston if you need assistance.

See [Strategic Goal 2.11](#)

Every semester, the Physics/Astronomy program has collected data in each of our Physics and Astronomy courses, in both lecture and lab sections, and for all the sections of each course as well, for the purpose of examining program learning outcomes (PLOs) for each of the degrees the Department offers;

the most recent SLO data only recently has been mapped by the SLO Cloud to be used to analyze Program Level Outcomes, and so initial results may need some careful reflection. This data will then be analyzed, the data will be discussed with both full-time and adjunct faculty, and the results will be used to develop strategies for improving instruction, to consider ways of possibly needing to alter the method of testing that determine whether or not the program learning outcomes have been adequately met, or to perhaps evaluate the program learning outcomes themselves and see if they need to be modified.

For the past several years, the program has assessed all of our active courses: Physics 101, Physics 200, Physics 150A, Physics 201, Physics 150B, Physics 210, Astronomy 120, Astronomy 125, and Engineering 265, and we have done so for all sections of each course, taught by both the full-time and adjunct faculty. We are beginning the third cycle of the SLO evaluation, and plan to use the data collected in the first two evaluation cycles to help improve instruction and/or alter the testing methods or the SLOs themselves, and correspondingly, the PLOs will be analyzed as outlined above.

The courses Astronomy 222 and Physics 222 are guided, independent study courses whose SLOs have not been assessed; for the several years, there has been no student interest/enrollment in these courses, and hence no means for the department to evaluate any student learning outcomes. Also, Physics 010, a CR/NC course designed to offer workshops to develop and strengthen basic skills needed to succeed in physics and other science courses, has never been offered, and never assessed.

The following are the Course to PLO maps for the Physics AS and the Astronomy AS Degrees, further, there are *excerpts* (in italics) from the SLO Cloud for what was done in each of our degree programs and the percentage of sections reporting (not to include SP2016):

	Physics AS Degree	Transfer to an accredited university as a junior with a major in physics or a physics-related major.	Integrate physical concepts and principles to other science disciplines.	Develop a world view that incorporates the role of physics in modern society.	Solve work-related problems by employing physical concepts to formulate and solve representative physical models.	Apply physical knowledge and skills required in securing and maintaining employment.	Demonstrate a proficiency in standard physics laboratory techniques commonly acquired in lower-division coursework.
CLASSES							
PHYSIC 200			X	X	X	X	X
PHYSIC 201			X	X	X	X	X
PHYSIC 210				X	X	X	X
MATH 250							
MATH 251							
MATH 252							

**Physics
Associate of Science Degree**

Students are prepared to:

1. Transfer to an accredited university as a junior with a major in physics or a physics-related major.
2. Integrate physical concepts and principles to other science disciplines.
3. Develop a world view that incorporates the role of physics in modern society.
4. Solve work-related problems by employing physical concepts to formulate and solve representative physical models.
5. Apply physical knowledge and skills required in securing and maintaining employment.
6. Demonstrate a proficiency in standard physics laboratory techniques commonly acquired in lower-division coursework.

Program Summary Report

Year

Period

Program

Tools

Program SLOs

Note: [Program SLO Summary Evaluation Form is available..](#)

Note: These contain duplicated head count. A student can be counted once for each statement in a SLO, and for each class they took.

#	SLO Statement	# of Students Assessed	# of Students who Met SLO	% of Students who Met SLO
1	Transfer to an accredited university as a junior with a major in physics or a PHYSIC-related major.			
2	Integrate physical concepts and principles to other science disciplines.	1392	1231	88.43%
3	Develop a world view that incorporates the role of physics in modern society.	1425	1264	88.70%
4	Solve work-related problems by employing physical concepts to formulate and solve representative physical models.	1425	1264	88.70%
5	Apply physical knowledge and skills required in securing and maintaining employment.	1425	1264	88.70%

6	Demonstrate a proficiency in standard physics laboratory techniques commonly acquired in lower-division coursework.	1425	1264	88.70%
7	N/A			

Assessment Method: ... For SLO #1 and SLO #2, for each of the five semester tests that were taken, a percentage of how many students scored within the grade ranges 100%-85%, 85%-70%, 70%-55%, 55%-45%, and 45%-0 was calculated to represent the students' ability to not only understand the basic concepts, but also to be able to solve a variety of physical situations. ...

Reflection:...On average, students seem to learn quite a lot from the labs, since the lab experiment provide the students a hands-on opportunity to make close connections between theory and the real, physical world, and to be able to directly apply the physical concepts and principles discussed in lecture.

... Reporting: 96.3%

Based on the rates of success of students meeting the SLOs for the courses that mapped onto the PLOs for the Physics AS Degree, it would seem that most of the Physics Program SLOs are being met quite successfully with all rates above 85%; however, the first SLO, which addresses the students' being able to transfer to an accredited university as a junior with a major in physics or a physics-related major is a difficult SLO to quantify, as we do not track the students after they transfer from SBVC; also, students often transfer to a four-year institution without completing the Physics AS Degree, gauging the SLO success rate in this case is difficult as well. The Department will work on how to best address the issue of evaluating this particular SLO, such as using capstone courses/assignments/exams, or perhaps consider necessary SLO revisions.

	Astronomy AS Degree	Transfer to an accredited university as a junior with a major in astronomy or an astronomy-related major.	Integrate physical concepts and principles to other science disciplines	Develop a world view that incorporates the role of physics in modern society	Solve work-related problems by employing physical concepts to formulate and solve representative physical models	Apply astronomical/physical knowledge and skills required in securing and maintaining employment	Demonstrate a proficiency in standard physics laboratory techniques commonly acquired in lower-division coursework
CLASSES							
ASTRON 120			X	X	X	X	X
ASTRON 125			X	X	X	X	X
PHYSICS 200			X	X	X	X	X

Astronomy

Associate of Science Degree

Students are prepared to:

1. Transfer to an accredited university as a junior with a major in astronomy or an astronomy-related major.
2. Integrate astronomical/physical concepts and principles to other science disciplines.
3. Develop a world view that incorporates the role of astronomy in modern society.
4. Solve work-related problems by employing astronomical/physical concepts to formulate and solve representative astronomical/physical models.
5. Apply astronomical/physical knowledge and skills required in securing and maintaining employment.
6. Demonstrate a proficiency in standard astronomical/physical laboratory techniques commonly acquired in lower-division coursework.

Program Summary Report

Year

2015 - 2016

Period

Last 3 Years

Program

Astronomy AS Degree

Tools

Program SLOs

Note: [Program SLO Summary Evaluation Form is available..](#)

Note: These contain duplicated head count. A student can be counted once for each statement in a SLO, and for each class they took.

#	SLO Statement	# of Students Assessed	# of Students who Met SLO	% of Students who Met SLO
1	Transfer to an accredited university as a junior with a major in physics or a physics-related major			
2	Integrate physical concepts and principles to other science disciplines	1575	1318	83.68%
3	Develop a world view that incorporates the role of physics in modern society	1575	1318	83.68%

4	Solve work-related problems by employing physical concepts to formulate and solve representative physical models	1575	1318	83.68%
5	Apply astronomical/physical knowledge and skills required in securing and maintaining employment.	1575	1318	83.68%
6	Demonstrate a proficiency in standard physics laboratory techniques commonly acquired in lower-division coursework	1575	1318	83.68%

Assessment Method: ... For SLO #3, a percentage of how many students had lab report averages falling within the same grade ranges was taken to represent the students' ability to analyze and interpret data, apply fundamental physics principles, evaluate results and analyze measurement errors.. ...

Reflection:.. By and large, students seemed to do relatively well in the general questions about identifying and describing basic physical concepts, but seemed to have difficulty in distinguishing concepts with similar-sounding terminology or with similar but related physical properties, particularly when the terms relating these concepts may have been incorrectly used prior to taking this Physics course...

Reporting: 62.2%

Based on the rates of success of students meeting the SLOs for the courses that mapped onto the PLOs for the Astronomy AS Degree, it would seem that most of the Astronomy Program SLOs are being met quite successfully with all rates above 83%; however, the first SLO, which addresses the students' being able to transfer to an accredited university as a junior with a major in physics or a physics-related major is a difficult SLO to quantify, as we do not track the students after they transfer from SBVC; also, students often transfer to a four-year institution without completing the Astronomy AS Degree, gauging the SLO success rate in this case is difficult as well. The Department will work on how to best address the issue of evaluating this particular SLO, such as using capstone courses/assignments/exams, or perhaps consider necessary SLO revisions.

The average reporting rate for the course to PLO mapping for the Physics AS Degree was 96.3%; the corresponding average reporting rate for the Astronomy AS Degree was 62.2%; the bulk of our majors classes in Physics is taught by full-time faculty; our Astronomy classes are presently taught only by adjunct faculty; until recently, our Engineering class had been taught by adjunct faculty; it seems that full-time faculty are more responsible in attending to the reporting of SLO data, and the higher percentage relative to the Physics AS Degree reflects this; the department will more vigorously strive to encourage adjunct faculty to report SLO data for all the sections they teach, every semester.

According to the EMP data for Physics/Astronomy 2014-2015, for the academic years 2012-13 through 2014-15, only six AS Degrees in Physics and Astronomy were awarded; according to the Three Year Summary Reports for the Physics AS Degree and for the Astronomy AS Degree, the average number of students who met the PLOs corresponding to the course mapping their degree programs was 1257 and 1318, respectively. There seems to be little correlation between the number of degrees awarded and how successfully the PLOs were met; apparently the completion of an AS Degree is but a small component the measure of how students successfully complete courses in Physics and Astronomy; many students take Physics and/or Astronomy classes as part of their degree programs in other majors, or simply to satisfy a general-education requirement. Thus, upon transferring to a four-year university after succeeding in all of their coursework at SBVC, whether the students have Physics/Astronomy AS Degrees or not, they are well-prepared to continue to pursue their various majors/career paths.

Part III: Questions Related to Strategic Initiative: Institutional Effectiveness

Strategic Initiative	Institutional Expectations	
	Does Not Meet	Meets
Part III: Institutional Effectiveness - Rubric		
Mission and Purpose	The program does not have a mission, or it does not clearly link with the institutional mission.	The program has a mission, and it links clearly with the institutional mission.
Productivity	The data does not show an acceptable level of productivity for the program, or the issue of productivity is not adequately addressed.	The data shows the program is productive at an acceptable level.
The Physics/Astronomy department provides quality education to students interested in fulfilling general education requirements in the physical sciences and to physics, math, engineering, chemistry, pre-health, pre-med, and other science majors at the lower division level. The Physics/Astronomy department endeavors to provide appropriately rigorous coursework in addition to instilling the skills and habits required for students to successfully major in their chosen field.	The Physics/Astronomy department provides quality education to students interested in fulfilling general education requirements in the physical sciences and to physics, math, engineering, chemistry, pre-health, pre-med, and other science majors at the lower division level. The Physics/Astronomy department endeavors to provide appropriately rigorous coursework in addition to instilling the skills and habits required for students to successfully major in their chosen field.	The Physics/Astronomy department provides quality education to students interested in fulfilling general education requirements in the physical sciences and to physics, math, engineering, chemistry, pre-health, pre-med, and other science majors at the lower division level. The Physics/Astronomy department endeavors to provide appropriately rigorous coursework in addition to instilling the skills and habits required for students to successfully major in their chosen field.

Mission and Purpose:

SBVC Mission: San Bernardino Valley College provides quality education and services that support a diverse community of learners.

What is the mission statement or purpose of the program?

The Physics/Astronomy Department provides quality education to students interested in fulfilling general education requirements in the physical sciences and to physics, math, engineering, chemistry, pre-health, pre-med, and other science majors at the lower division level. The Physics/Astronomy department endeavors to provide appropriately rigorous coursework in addition to instilling the skills and habits required for students to successfully major in their chosen field.

How does this purpose relate to the college mission?

The mission of the college is: San Bernardino Valley College maintains a culture of continuous improvement and a commitment to provide high-quality education, innovative instruction, and services to a diverse community of learners. Its mission is to prepare students for transfer to four-year universities, to enter the workforce by earning applied degrees and certificates, to foster economic growth and global competitiveness through workforce development, and to improve the quality of life in the Inland Empire and beyond.

The mission of the college is consistent with the mission of the Physics/Astronomy department.

Productivity

Provide additional analysis and explanation of the productivity data and narrative in the EMP Summary, if needed. (Use data from charts 1 and 2 (FTEs; Enrollment; FTFE and WSCH per FTFE) on page 3 of this form). Explain any unique aspects of the program that impact productivity data for example; Federal Guidelines, Perkins, number of workstations, licenses, etc.

The Physics/Astronomy program's EMP summary reflects the time period after which we were attempting to increase FTES, and when class sections had been reduced, and the goal at the time was to increase efficiency while keeping the number of sections low. To that end, the program had attempted to offer mostly double sections of Physics 101, and to continue to offer both Physics 150A/Physics 200, and Physics 150B/Physics 201 as effectively double lecture sections. This trend of double lecture sections has continued, even as the number of sections has increased by 46% between the 2010-11 and 2014-15 academic years; correspondingly, the FTES of the program has steadily risen, from 117.15 to 168.31, with respect to the same time period, the duplicated enrollments have increased from 604 to 797 respectively, and the WSCH per FTEF has grown from 591 in the year 2011-12, peaked at 643 in 2013-14, and then declined to 599 in 2014-15. The program is very satisfied with this efficiency. Further, budget considerations allowing, when the program will be permitted to offer more sections of all of our courses, both lectures and labs, to maintain and/or to increase efficiency, the use of double lecture sections will be continued and encouraged.

Relevance and Currency, Articulation of Curriculum

If applicable to your area, describe your curriculum by answering the questions that appear after the Content Review Summary from Curricunet.

The Content Review Summary from Curricunet indicates the program's current curriculum status. If curriculum is out of date, explain the circumstances and plans to remedy the discrepancy.

The independent study Physics and Astronomy courses Physics 222 and Astronomy 222 are current. Physics 101, Astronomy 120, Astronomy 125, Physics 150A, Physics 150B, Physics 200, Physics 201, and Physics 210 had their last content review in 2009. The department recognizes its oversight in not having these courses reviewed by last December, and it will complete the reviews of these courses by the beginning of Fall 2016.

CURRICUNET REPORT IS PROVIDED

Content Review

Science				
Physics & Astronomy				
	Course	Status	Last Content Review	Next Review Date
	PHYSIC101 Introductory Physics	Active	12/07/2009	12/07/2015
	ASTRON120 Introduction to Astronomy	Active	12/07/2009	12/07/2015
	ASTRON125 Astronomy Laboratory	Active	12/07/2009	12/07/2015
	PHYSIC150A General Physics for the Life Sciences I	Active	12/07/2009	12/07/2015
	PHYSIC150B General Physics for the Life Sciences II	Active	12/07/2009	12/07/2015
	PHYSIC200 Physics I	Active	12/07/2009	12/07/2015
	PHYSIC201 Physics II	Active	12/07/2009	12/07/2015
	PHYSIC210 Modern Physics	Active	12/07/2009	12/07/2015
	ASTRON222 Independent Study in Astronomy	Active	10/06/2014	10/06/2020
	PHYSIC222 Independent Study in Physics	Active	10/06/2014	10/06/2020
	PHYSIC101 Basic Physics	Historical		
	ASTRON120 Introduction to Astronomy	Historical		
	ASTRON123 Introduction to Astronomy	Historical		
	ASTRON123 Introduction to Astronomy	Historical		
	ASTRON125 Astronomy Laboratory	Historical		
	PHYSIC150A General Physics for the Life Sciences I	Historical		
	PHYSIC150B General Physics for the Life Sciences II	Historical		
	PHYSIC200 Physics I	Historical		
	PHYSIC201 Physics II	Historical		
	PHYSIC210 Modern Physics	Historical		
	PHYSIC222 Special Problems in Physics I	Historical		
	PHYSIC223 Special Problems in Physics II	Historical		
	PHYSIC223 Special Problems in Physics II	Historical		
	ASTRON223 Special Problems in Astron II	Historical		

Articulation and Transfer

List Courses above 100 where articulation or transfer is not occurring	With CSU	With UC

Describe your plans to make these course(s) qualify for articulation or transfer. Describe any exceptions to courses above 100.

All current Physics and Astronomy courses offered by the Physics/Astronomy department articulate for transfer.

Currency

Follow the link below and review the last college catalog data.

<http://www.valleycollege.edu/academic-career-programs/college-catalog.aspx>

Is the information given accurate? Which courses are no longer being offered? (Include Course # and Title of the Course). If the information is inaccurate and/or there are listed courses not offered, how does the program plan to remedy the discrepancy?

The information in the college catalog is accurate. We have not yet offered Physics 010, a course designed to offer workshops to develop and strengthen basic skills needed to succeed in physics and other science courses. This course had been placed in the catalog, in concert with other departments, in order to try and improve basic skills of incoming science students and thus improve their success and retention rates. Particularly due to budget considerations, this course has not been a high priority, especially with the continuing success and expansion of the Student Success Center services. The department wishes to maintain this course, so that in the future, as necessary, the course may be offered to aid incoming physics/science students in succeeding in their respective science programs.

Part IV: Planning

Strategic Initiative	Institutional Expectations	
	Does Not Meet	Meets
Part IV: Planning - Rubric		
Trends	The program does not identify major trends, or the plans are not supported by the data and information provided.	The program <u>identifies and describes</u> major trends in the field. Program addresses how trends will affect enrollment and planning. Provide data or research from the field for support.
Accomplishments	The program does not incorporate accomplishments and strengths into planning.	The program incorporates substantial accomplishments and strengths into planning.
Challenges	The program does not incorporate weaknesses and challenges into planning.	The program incorporates weaknesses and challenges into planning.

What are the trends, in the field or discipline, impacting your student enrollment/service utilization? How will these trends impact program planning?

There is a national concern that there are too few physical sciences and engineering majors at the baccalaureate and graduate levels.

Most professional schools, for example, medical schools, have a recency requirement for applicants such that they have successfully completed their science classes within the last five years. Some of our students are returning students working to meet these requirements.

According to the labor market information obtained from the website www.labormarketinfo.edd.ca.gov, the following are some sample projected growth rates for jobs in California, for 2012-2022, in the following fields: Biomedical Engineer, 42.6%; Biochemists and Biophysicists, 27.0%; Physician assistants, 33.7%; Registered Nurses, 16.9%; Post-secondary Physics Instructors, 15.4%; Geoscientists, 22.4%; Physicists, 18.4%; Environmental Engineer, 24.7%; Civil Engineers, 18.3%; Physical Scientists, 20.7%; Nuclear Engineers, 20.0%; Aerospace Engineers, 18.5%. Further, Clearly there is a strong demand for physics instructors, engineers, and other professions which need Physics as part of the core course requirements for students entering such fields in the physical sciences and the health professions, and the Physics/Astronomy program provides these core requirements. The labor market information website cited above gives projected job growth rates in California, for 2012-2022, in the professional fields of Biochemists, Biophysicists, Registered Nurses, Physician's Assistants, all of which are directly linked to the present lack of individuals working in these fields. The chronic shortage of health care professionals, both locally and nationally, in addition to newly opened medical school at UC-Riverside, will increase the demand and interest for major's preparation classes required of students interested in medical sciences. We predict an increase in enrollment in response to these trends.

There is also a continuing national trend to emphasize Science, Technology, Engineering, and Mathematics (STEM) education in order to address the problem of a national lack of individuals who are qualified to work in fields involving science, engineering, mathematics, and technology. (Office of the President, www.whitehouse.gov/blog/2016/02/11/stem-all) This trend directly affects the Physics/Astronomy department since all science students are required to complete at least Physics 150A/150B, or Physics 200/201. Presently, both our day and evening sections of Physics 150A and Physics 200 are full, and we also have filled two single sections and two double section of Physics 101, which is a prerequisite for the higher level Physics courses. If enrollments continue to be high, with correspondingly long waiting lists, budget considerations allowing, we will need to add more sections of all Physics sections to meet the increased demand.

The past budget crisis and present economic recovery had caused our local universities (University of California system) and state colleges (California State University system) to cut back on their enrollments and class offerings, which pushed more students to attend SBVC and increased enrollments at this college; but budget problems had also caused SBVC's offerings to be cut as well; as a result, even during this economic recovery, and even with SBVC offering more courses, all our classes are still full to capacity, with many desperate students on waiting lists. Clearly, if we had more sections available for all our science classes, they would easily fill; so budget considerations allowing, we look toward increasing our all of our Physics and Astronomy sections, whenever possible.

Part of our growth in the department and in the Science Division as a whole is directly attributable to the peer-led community fostered by the Student Success Center. However, following our past budget crisis, the present conservative economic policies in state funding has resulted in less-than-robust assistance for student support services; further, the grant which funded the SI program at SBVC is soon coming to an end, resulting in fewer SI leaders and fewer tutors campus-wide for the coming academic year. This decrease in student service may result in a decrease in enrollment, and, more importantly, a decrease in student success rates.

Accomplishments and Strengths

Referencing the narratives in the EMP Summary, provide any additional data or new information regarding the accomplishments of the program, if applicable. In what way does your planning address accomplishments and strengths in the program?

The Physics/Astronomy program continues to maintain a strong program of courses to students interested in fulfilling general education requirements in the physical sciences and to physics, math, engineering, chemistry, pre-health, pre-med, and other science majors at the lower division level. The Physics/Astronomy department also plans to maintain and increase, if possible, the number of STEM majors, with the able assistance of the tutors, SI leaders, and facilitators at the Student Success Center. The department has successfully run on-line hybrid Astronomy course for a number of years, it is presently offering day and evening traditional Astronomy lecture sections, and it will continue to explore the possibility of an on-line Physics 101 course. If budget considerations allow our increasing our number of section

offerings, the department will explore the possibility of having the more sections of the Physics 150A/B and Physics 200/201 sequences which will continue to be offered in the Spring as well as in the Fall. Again, budget allowing, the department will strive to continue to update the Physics labs and their related equipment needs, as well as updating and improving the lecture-demonstration needs.

Recent interest in Physics and engineering has allowed us, for the past few years, to successfully offer Modern Physics 210 in the Summer session and Engineering Statics 265 in Spring; however, enrollments in both these courses has been traditionally low, and the department is working to find effective ways of increasing the interest and enrollments in each of these classes. The department has also been able to increase our night offerings for Physics 101 and to have more Astronomy 120 sections in both Fall and Spring semesters. The department plans to continue these increased section offerings to provide students with more access to our program.

The department has supported, and plans to continue supporting the past Math and Science Student Success Center, as well as the present Student Success Center, and has collaborated with UC Riverside and Cal Poly Pomona in providing our Physics students with very effective tutors who are/were advanced students and were recently Physics students at SBVC.

Planetarium shows have been presented throughout each academic year for the general public, for elementary and secondary school programs, for various SBVC physical sciences classes, for various SBVC groups/programs/organizations, and for special outside groups/programs. For the past four years, from September 2011-May 2015, the average combined yearly audience of the Planetarium shows has been approximately 3858 with an average yearly income of \$3726; the department plans to continue this most valuable outreach program.

Following the public shows, the N.A.Richardson Observatory has also been opened to provide views of the Moon and planets, with an average yearly total of approximately 250 people attending the viewings. This is the oldest observatory in the valley and contains a very historic telescope.

The planetarium has participated in and presented shows for any of the "Science Day" activities, and will continue to do so.

The planetarium instrument was professionally serviced recently to ensure its successful, continued operation for both academic and public outreach purposes.

During the recent move to the new Physical Science building, the Planetarium Specialist had discovered and collected older scientific equipment and/or historical college artifacts; deciding that this important part of SBVC's history should be preserved and displayed, he prepared the first floor of the N.A.Richardson Observatory to be the new Science Museum by arranging display cases from the old Life Science, Chemistry, and Physical Science buildings to now exhibit the interesting and historical science equipment; the Planetarium Specialist also serves as the unofficial college historian and plans for the safe keeping of items from the old SBVC campus.

In Fall 2013, the Department had successfully established the Associate in Arts in Physics for Transfer Degree (AS-T in Physics) which is designed to prepare students for transfer into the CSU system to complete a baccalaureate degree in Physics.

One of the Department's adjunct instructors is piloting the use of Web-Assign in his Physics 150AB and Physics 200/201 courses to test the effectiveness of such on-line practice problem-solving software for our upper division courses; he is also incorporating the "clicker" technology for automated immediate response and statistical analysis capabilities in his lecture presentations; a similar automated student response system linked with the presentation software developed by the Astronomy text publishers was initiated by and, for the past few years, successfully implemented by our Astronomy Adjunct Professor in his Astronomy lecture course.

Physics courses were offered using multiple lab sections in order to allow students more flexibility in scheduling and to provide viability for low-enrolled courses; further, as initiated by and in coordination with the Chemistry department chair and with other Science Division department chairs, courses were offered

in a way not to conflict with other science major lecture and/or lab offerings to allow the students to more easily construct and complete their individual major programs; this very effective practice will continue.

Challenges

Referencing the narratives in the EMP Summary and/or your data, provide any additional data or new information regarding planning for the program. In what way does your planning address trends and weaknesses in the program?

In recent years, with the addition of more Physics and Astronomy classes to meet demand, the faculty course load has grown significantly (presently at about 4.80, or 41.7% of classes being taught by full-time faculty), and, as a result, with only two full time faculty, the department has needed to use several adjunct faculty. However, it is very difficult to find instructors who are well-qualified to teach Physics and/or Astronomy, and with such a small pool of adjuncts, the program has suffered; occasionally, for lack of adjuncts and/or scheduling conflicts, classes were cancelled, or the full time faculty sought special permission to take extra overload to cover all courses. An unstable workforce greatly increases the difficulty in providing quality, consistent service at the appropriate level of rigor. Furthermore, with only two full-time faculty, opportunity for innovation is limited, continuity of instruction in adjunct-taught courses is sporadic, at best, this would not support quality instruction for our students, and it stifles successful attempts of program growth, development and expansion. It is very difficult to find qualified faculty to teach Physics and Astronomy, and the usual turnover associated with adjunct instructors versus the consistency afforded by full-time faculty negatively impacts quality of instruction, enrollments, and, ultimately, productivity. Further, without additional full-time faculty, the Engineering program will not have an opportunity to expand and grow, and progress relative to the STEM initiatives will be negatively impacted.

In the near future, the Planetarium Specialist will be retiring; as there is no foreseeable replacement for this position, this will create a tremendous loss: there will be no vital planetarium services available for astronomy lecture and/or lab instruction, none available for other physical science instructors or for other disciplines, and no planetarium shows, tours, or presentations available for the many schools and individuals of our local community. On average, through various Planetarium presentations, SBVC presently serves in excess of 3000 elementary, middle school, and high school students yearly; the Planetarium is clearly a most valuable academic resource and provides vital community outreach activities. Furthermore, the Astronomy program is growing, with the department needing to add more lecture and lab classes to meet student demand. The department hopes to secure a new faculty position to be a Physics/Astronomy instructor who not only could fill the need for teaching an ever-growing number of Physics and Astronomy classes as well as adding stability and growth to the Astronomy program, but also, perhaps through reassigned time, could work to guide and grow the Planetarium programs and resources together with maintaining and supporting all the vital Planetarium activities provided by the present SBVC Planetarium Specialist. Without a faculty to help assume the responsibilities of the Planetarium Specialist, a most vital academic resource and a most important community outreach tool will be lost.

The Physics Laboratory Technician retired at the end of 2005. This full-time position has been replaced by a half-time position, and the Physics/Astronomy laboratory and lecture programs have been negatively impacted by having only part-time laboratory assistance; this is still less than what was available in Physics/Astronomy before the previous lab technician retired; thus, the level of student service the department can provide with respect to the assistance provided by the lab technician in both lecture and lab has not quite reached pre-2005 levels. In recent years, with the addition of more Physics and Astronomy classes to meet demand, the faculty course load has grown significantly (presently at about 4.80), and, as a result, the corresponding responsibilities of the Physics Laboratory Technician have increased significantly as well. Presently, the Physics Lab tech is responsible for setting up 15 labs

weekly, as well as assisting all Physics/Astronomy instructors (2 full time with overloads, and 4-5 part-time) with various lecture and lab demonstrations that are used to enhance the lecture and lab presentations; furthermore, only two lab rooms are available for these Physics/Astronomy labs, so each lab room gets multiple use, which demands more frequent equipment changes. Further, not only does all this lab and demonstration equipment need to be maintained and/or repaired, but the Physics Lab tech also orders equipment/supplies when necessary, and assists in other Science division activities such as Science and Technology Day. The Physics Lab Tech position is presently only half-time, and with the present/projected growth in our Physics/Astronomy program, there will be a need for the Physics lab tech position to be increased to full-time in order for the Physics lab tech to properly perform all necessary tasks related to the support of lecture and lab instruction. The department hopes to secure a new faculty position to be a Physics/Astronomy instructor who could help teach the growing numbers of Physics and Astronomy classes, add stability and growth to the Astronomy program, and work to guide and grow the Planetarium programs and resources together with maintaining and supporting all the vital Planetarium activities provided by the Planetarium Specialist; the department will then correspondingly also need the Physics lab tech position to be increased to full time in order that the lab tech assist not only in the needs of the Physics/Astronomy lectures and labs, but also in the needs of the Planetarium programs for our college classes as well as various academic and community outreach activities.

The present layout of the large lecture rooms and labs is not well-suited for physics lecture demonstrations, as the physics lab tech area, where most of the lab and lecture/demonstration equipment is kept, is physically located far from the large lecture rooms, and ready and quick access to these rooms is difficult, at best. The department is thus planning to modify its lecture/demonstration procedures, as well as planning to purchase equipment for lecture/demonstrations and labs that are better suited to the present, more limited, and more restricted conditions; as budget considerations allow.

Our level of permanent funding is often not consistent with what is required to run this program by way of lab equipment, lecture demonstration equipment, supplies, and what is used and/or consumed on a regular basis in lecture and lab. Until budget allows proper funding, the department will continue to seek ways to increase the lifespan and efficiency of the equipment we have available and of the lecture/lab consumables without compromising the curriculum.

If the program expands significantly, and budget allowing, the department may consider trying to have the Physics lab technician position be restored to full-time status.

Due to budget considerations, the instability in student support services through the Student Success Center creates an inconsistent level of service that directly impacts student success. The department is committed to strongly encouraging students to take advantage of the various services provided. Strong empirical data shows a huge increase in student success for those students who make use of tutoring opportunities, workshops, and the peer-led model offered through the Student Success Center. All faculty in the department will announce activities in their respective classes and provide incentives for student participation, such as extra credit.

V: Questions Related to Strategic Initiative: Technology, Campus Climate and Partnerships

Strategic Initiative	Institutional Expectations	
	Does Not Meet	Meets
Part V: Technology, Partnerships & Campus Climate		
	<p>Program does not demonstrate that it incorporates the strategic initiatives of Technology, Partnerships, or Campus Climate.</p> <p>Program does not have plans to implement the strategic initiatives of Technology, Partnerships, or Campus Climate</p>	<p>Program demonstrates that it incorporates the strategic initiatives of Technology, Partnerships and/or Campus Climate.</p> <p>Program has plans to further implement the strategic initiatives of Technology, Partnerships and/or Campus Climate.</p>

Describe how your program has addressed the strategic initiatives of technology, campus climate and/or partnerships that apply to your program. What plans does your program have to further implement any of these initiatives?

<p>Technology:</p> <p>The department will continue to offer an Astronomy 120 hybrid/on-line course. The content is continuously updated and improved with new video material.</p> <p>The department also operates and maintains the George F. Beattie Planetarium and the N. A. Richardson Astronomical Observatory, but the Planetarium is officially under the direction of the Science Division Dean. The Planetarium provides visual demonstrations that support the Astronomy classes offered by the department, and it also offers a series of programs for public school classes and for the general public. These programs provide an introduction to the current night sky and multimedia presentations of topics in Astronomy. Also, following a Planetarium presentation, the Planetarium specialist often encourages those interested to become aware of the opportunities available at SBVC to further their education and/or personal knowledge in Astronomy, Physics, or other science-related courses.</p> <p>The department occasionally uses video presentations in Physics, and very often uses physical demonstrations to clarify and/or augment topics discussed in Physics/Astronomy lecture and lab.</p> <p>In our Physics/Astronomy labs, the department has begun to incorporate digital scales and digital electric multimeters to improve accuracy and facilitate learning; more equipment and lab updates are planned, budget considerations allowing.</p> <p>In one of our Astronomy lectures, the instructor is using the “clicker” class management technology to enhance student response and performance, to provide immediate feedback to the instructor relative to class discussions, to ease the process of test/quiz taking, and to provide quick access to data to evaluate student performance. Also, this same instructor uses a power-point like format to present his Astronomy lectures.</p> <p>One of the Department’s adjunct instructors is piloting the use of Web-Assign in his Physics 150AB and Physics 200/201 courses to test the effectiveness of such on-line practice problem-solving software for</p>

our upper division courses; he is also incorporating the “clicker” technology for automated immediate response and statistical analysis capabilities in his lecture presentations.

Students in our Astronomy labs have successfully performed several on-line lab exercises in Astronomy through CLEA. The lab students also work with Astronomy software and newly-acquired laptops to simulate a planetarium environment.

All Physics/Astronomy students are encouraged to use the computer labs available either in the Physical Sciences building, or elsewhere on campus, in order to better organize, graph, and analyze their lab data as well as to generally their lab reports.

Both the texts in Astronomy and in Physics 150AB/200-201 have associated on-line student help sources available for the students to improve their performance, and the department encourages use of these resources; further, the new Astronomy textbooks also include pre-packaged planetarium software, which students can use to augment the Planetarium presentations made in the lectures.

The department is continuing the exploration of the use of Fourier Systems Data Logging Kits in the Physics and Astronomy labs if funding becomes available.

Campus Climate/Partnerships

Planetarium shows have been presented throughout each academic year for the general public, for elementary and secondary school programs, for various SBVC physical sciences classes, for various SBVC groups/programs/organizations, and for special outside groups/programs. For the past four years, from September 2011-May 2015, the average combined yearly audience of the Planetarium shows has been approximately 3858 with an average yearly income of \$3726; the department plans to continue this most valuable outreach program.

Following the public shows, the N.A.Richardson Observatory has also been opened to provide views of the Moon and planets, with an average yearly total of approximately 250 people attending the viewings. This is the oldest observatory in the valley and contains a very historic telescope.

The planetarium has participated in and presented shows for any of the “Science Day” activities taking place at SBVC, and will continue to do so.

The Planetarium specialist is continually making presentations and conducting activities that involve the general public, or other schools/organizations outside of SBVC; these all contribute tremendously and in a most positive way to the reputation of SBVC and is supportive of its mission; this most valuable outreach effort will continue. The Planetarium specialist also provides special astronomy presentations for various classes associated with various departments at SBVC both within and outside of the Science Division, and will continue these efforts.

In coordination with the CSUSB Department of Health Science and Human Ecology, Environmental Health Science Program, the Physics/Astronomy department has been and supporting efforts to develop a certificate program in vector control at CSUSB which would include SBVC; this partnership will continue.

The Physics/Astronomy department, in collaboration with SBVC’s Financial Aid office and the Outreach Department, has participated for the last several years in Science Day. This program brings approximately 300 local high school students to the campus to explore topics in science and math and to learn about the application and financial aid processes. This activity increases not only a college-wide appreciation of diversity, but also encourages diversity in the population of our future students.

Further, our other Physics full-time faculty has not only done several workshops for middle and elementary schools where young girls and boys are encouraged to enter the physical sciences, but she is also an advisor of the STEM club at SBVC which has many female members

Physics courses are offered using several lab sections in order to allow students more flexibility in scheduling and to provide viability for low-enrolled courses; further, as initiated by and in coordination with the Chemistry department chair, courses were offered in a way not to conflict with other science major

lecture and/or lab offerings to allow the students to more easily construct and complete their individual major programs.

The department is committed to strongly encouraging students to take advantage of the various services provided, and has worked with other departments within the Science Division and also with the Math Division to encourage an increase in student success by encouraging students to make use of tutoring opportunities, workshops, and the peer-led model offered through the Math and Science Student Success Center. All faculty in the department announce activities in their respective classes and provide incentives for student participation, such as extra credit.

The department actively continues to work with Counseling and with the Articulation officer to enhance student success.

The Physics/Astronomy department, together with other departments within the Science Division, is also participating in beginning outreach efforts to partner with local elementary and/or middle schools, such as Richardson Middle School.

VI: Previous Does Not Meets Categories

Listed below, from your most recent Program Efficacy document, are those areas which previously received “Does Not Meet.” Address each area, by describing below how your program has remedied these deficiencies, and, if these areas have been discussed elsewhere in this current document, provide the section where these discussions can be located.

Program Review 2012 team efficacy report does not identify any department deficiencies.