EL CAMINO COLLEGE
NATURAL SCIENCES DIVISION

INSTRUCTIONAL PROGRAM REVIEW

ACADEMIC YEAR: 2013-2014
DEPARTMENT: PHYSICS

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1. Overview of the Program

a) Provide a brief narrative description of the current program, including the program's mission statement and the students it serves.

Program's Mission Statement:

The Mission of the Physics Department is to offer quality educational opportunities for students by providing courses that transfer to four-year institutions and offering associate degree courses that meet general education requirements.

Courses Offered and Students Served:

The program serves an average of about 1300 students per year.

- For majors in Engineering, Physics, Chemistry and Mathematics, the Physics department offers four courses: Physics1A- Mechanics; Physics1B-Fluids, Heat, Sound; Physics1C-Electricity; and Physics 1D -Optics, Modern Physics. (About 16 sections offered per year).
- For pre-professionals, Architecture majors, Physical Therapy majors and others transferring to institutions that require algebra-based physics, the department offers Physics 2A and 2B. Physics 2A includes mechanics, fluids, heat and sound, and Physics 2B electricity, optics, and modern physics. (About 11 sections offered per year).
- For pre-professionals transferring to institutions that require two semesters of physics with calculus, the department offers Physics 3A and 3B. Physics 3A includes mechanics, fluids, heat and sound, and Physics 3B electricity, optics, and modern physics. (About 4 sections offered per year)
- Physics 11 and Physics 12 are offered to meet requirements of transfer students in non-science majors. (About 8 sections offered per year)
- For students preparing to teach at the elementary and middle school level the department offers Physical Science 25. Topics include energy, magnetism, electricity, gravity, the periodic table of elements, and physical and chemical changes. (One section offered every year).

b) Describe the degrees and/or certificates offered by the program.

The Physics Department offers an AS-T degree for transfer. The Associate in Science for Transfer (AS-T) is intended for students who plan to complete a bachelor's degree in a similar major at a CSU campus. Students completing the AS-T are given priority consideration for admission to the CSU system, but not to a particular campus or major.

c) Explain how the program fulfills the college's mission and aligns with the strategic initiatives. (see Appendix A)

The Physics Department fulfills the college mission by offering a strong academic program supported by four full-time instructors and part time instructors, one full time technician and one part-time technician. Instructors aspire to foster a positive learning

environment and to deliver quality education in order to facilitate students' educational success.

The Physics Program aligns with strategic initiative A and strategic initiative B: Instructors enhance students' experience in class by using a variety of experiments and demonstrations of physical phenomena as part of most lectures. To further facilitate student success, the servicers of LRC tutors are made available to students as well as the services of facilitators in the MESA program and an online tutoring service sponsored by the HSI-STEM grant.

The Physics Program aligns with strategic initiative E: By using effectively the results of SLO assessment data, the Physics Program will strive to improve student learning, particularly in the area of conceptual understanding of physical phenomena.

d) Discuss the status of recommendations from your previous program review.

Recommendations from the previous Program Review are listed below along with a summary of their status.

1) Replace full time instructors with other full time instructors in the event that such instructors retire or resign.($80,000 per FT faculty).
Status: COMPLETED.
The retirement of Leon Leonardo at the end of Spring 2011, and the retirement of Norm Kadomoto at the end of Fall 2011, had left only two-full time instructors, who between them could cover less than 50% of the Department's course offerings. The department has now hired two new full-time physics instructors, John Coroneus and Susan Stolovy, bringing the department back to normal staffing levels.

2) More tutors are needed to help students who need review work in courses in which they are enrolled in.($10-$15 per hour)
Status: ACTIVE.
The physics department has had, for the past few years, an excellent tutor at Learning Resource Center. Students can also use the services provided by the MESA facilitators, and an online tutoring service. Finding skillful tutors is an ongoing and difficult task for physics instructors and for Arturo Hernandez, director of the MESA program.

3) Day and evening technicians' job list should be extended to include being available for the first hour in 1C, 3B and 2B labs to assist students with electrical equipment when the instructor cannot get around to all groups needing help.
Status: ON HOLD.
No progress has been made on this proposal. Dan Wright, one of our technicians, has been available to provide assistance to students during lab time; however, this item has not been included in the official job list.

4) Technicians should post, and constantly update, a list of the current projects along with the technician primarily responsible for the individual projects. The status of individual projects and

the expected dates of completion should be included. There should also be a place where instructors may post, in writing, requests for new projects/demos/repairs.
Status: ABANDONED.
Instructors communicate with technicians and keep track of expected dates of completion of projects.

5) Adjunct instructors should keep at least one (paid) office hour per week for each class they teach.($70 per hour).
Status: ON HOLD.
No progress has been made on this proposal. Some adjunct instructors hold unpaid office hours. We may want to bring this concern to the union so that we can explore the possibility of paying adjunct instructors for office hours.

6) Acquire equipment for lab work and for demonstrations when funds become available.($17 200).
The following table shows items requested by faculty for the improvement of instruction in 2009:

ITEM	AMOUNT	PURPOSE	COST
1. Micrometers (0-1 inch)	5	Lab experiments and demonstrations	$1250
2. Sodium ballasts and Lamps	5 ballast 10 lamps	Lab experiments and demonstrations	$ 2200
3. 140 Watt digital power supply WLS-30972-50 (Sargent Welch)	1	Lab experiments and demonstrations	$ 900
4. Radiological Survey Meter CP7152-02	1	Lab experiments and demonstrations	$ 1000
5. 6000g Ohaus Scout Pro Balance WLS-1761-57 (Sargent Welch)	1	Lab experiments and demonstrations	$ 650
6. Wave Motion Demonstrator SE9600 (Pasco)	1	Lab experiments and demonstrations	$ 800
7. Balloon Popping Green Laser-Elite 125 plus from wickedlasers.com	1	Lab experiments and demonstrations	$ 800
8. Ray Optic Laser System-SE 8506 (Pasco)	1	Lab experiments and demonstrations	$ 800
9. 2-meter tracks (Pasco, ME-6954)	5	Lab experiments	$ 1600
10. UV source for photoelectric effect demo	1	Demonstration	
11. Large Capacitor	1	Demonstrations	$ 400
12. Scanner	1	Data collection in lab	$ 150

13. Millikan oil exp (SW)	1	Demonstration	$6000
14. x-ray diffraction demo using microwaves (PASCO)	1	Demonstration	$1600
15. Blood pressure measurement apparatus	1	Demonstration	$50

Status: ACTIVE Most of the listed items have now been acquired. The items are still needed are: Item 5, item 9, item 10, item 11, item 13, item 14.

7) Physics 1D should change from being a 3-unit course to a 4-unit course to allow adequate time to cover quantum mechanics.
Status: COMPLETED.
This proposal was resubmitted to Dr. Arce in Spring 2013 and it has been subsequently approved. Physics instructors strongly believe the increasing the number of units for Physics 1D from 3 to 4 units would allow the department to offer adequate background to students in quantum mechanics. Basic knowledge of quantum mechanics is expected of students transferring to most four-year institutions.

8) Continue to improve the labs and to make up more interesting labs that can be done with reasonably inexpensive equipment by students with little experience.
Status: ACTIVE.
This continues to be a priority item. We continue to make improvements, particularly in the Physics 1B labs by adding a surface tension lab and revising other labs. We expect to continue to fulfill this priority as funds become available. The equipment needed is listed in the Facilities and Equipment and Technology and Software part of this document as well as in the Program Plan Builder document.

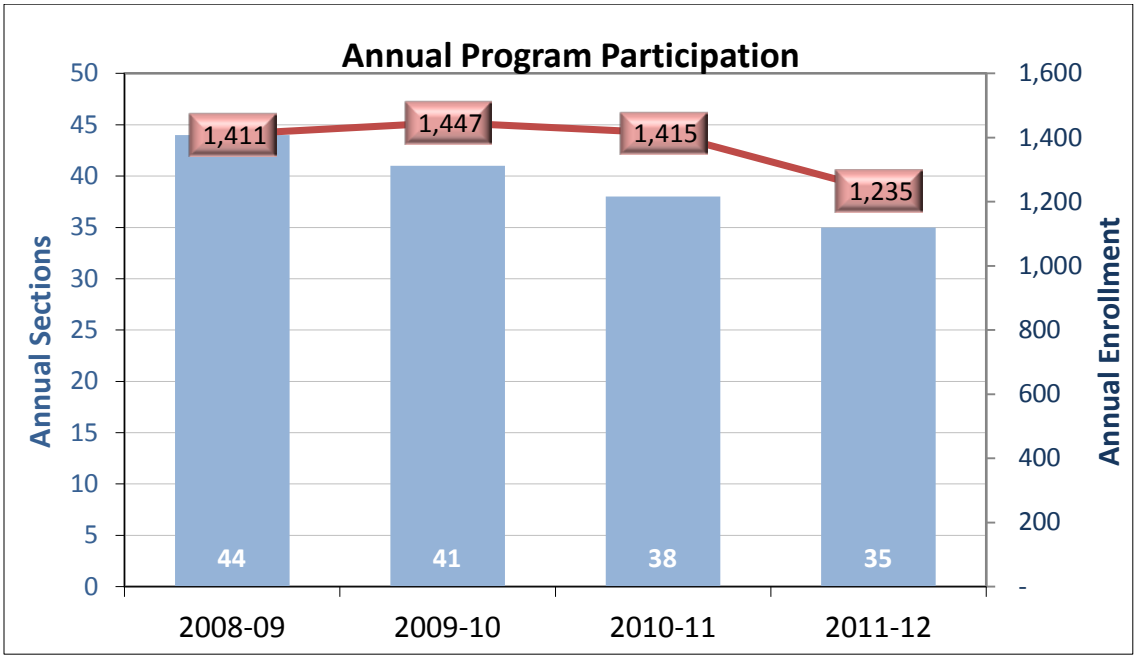
9) Continue to explore new technologies, and improve upon old technologies, with the goal being to enable the instructor to interact more and in a more meaningful way with students.
Status: ACTIVE
This continues to be a priority item. We use the internet more often in our courses. We have updated some of our labs with new technology we have, for example, improved the way in which students acquire data in a Physics 1B lab. We expect to continue to fulfill this priority as funds become available. The equipment needed is listed in the Facilities and Equipment and the Technology and Software of this document as well as in the Program Plan Builder document.

2. <u>Analysis of Research Data</u> (include data provided by Institutional Research & Planning)

a) Provide and <u>analyze</u> the following statistics/data.

1. Head count of students in the program

TOTAL ANNUAL PROGRAM PARTICIPATION



The demand for physics classes has been strong, but there has been a reduction in the number of sections offered from between 2009 to 2012 due to budgetary constraints.

2. Course grade distribution

The table below shows grade distributions, retention rates and success rates of the students from spring 2009-spring 2012. Success and retention rates shown in pink are one standard deviation above the mean and those one standard deviation below the mean are shown in blue.

			Grade Distribution												
Year	COURSE	Method	'A'	'B'	'C'	'D'	'F'	Inc NP	'DR'	'W'	*Total*	Retained	Succ.	Reten.	
2009	PHYS-11	Lecture	23	35	34	6	25	-	7	12	***142***	123	64.8%	86.6%	
	PHYS-12	Laboratory	3	15	-	-	-	-	-	-	***18***	18	*100.0%*	*100.0%*	
	PHYS-1A	Lecture	14	18	25	6	9	-	2	40	***114***	72	**50.0%**	**63.2%**	
	PHYS-1C	Lecture	2	12	19	-	2	-	-	5	***40***	35	82.5%	87.5%	
	PHYS-1D	Lecture	1	6	10	3	2	-	-	6	***28***	22	60.7%	78.6%	
	PHYS-2A	Lecture	26	39	22	1	1	4	3	37	***133***	93	65.4%	69.9%	
	PHYS-2B	Lecture	4	3	9	2	1	-	-	5	***24***	19	66.7%	79.2%	
	PHYS-3A	Lecture	5	8	2	-	4	-	2	5	***26***	19	57.7%	73.1%	
	PHYS-3B	Lecture	11	9	2	-	-	-	-	1	***23***	22	*95.7%*	95.7%	
2009 Total	2009		89	145	123	18	44	4	14	111	***548***	423	65.1%	77.2%	
2010	PHYS-11	Lecture	20	29	29	10	4	-	5	19	***116***	92	67.2%	79.3%	
	PHYS-12	Laboratory	3	9	4	-	-	-	2	2	***20***	16	80.0%	80.0%	
	PHYS-1A	Lecture	11	34	27	14	11	-	4	29	***130***	97	55.4%	74.6%	
	PHYS-1B	Lecture	8	17	15	2	7	1	2	11	***63***	52	65.1%	79.4%	
	PHYS-1C	Lecture	8	11	13	1	-	-	1	5	***39***	33	82.1%	84.6%	
	PHYS-1D	Lecture	5	16	10	3	1	-	1	4	***40***	35	77.5%	87.5%	
	PHYS-2A	Lecture	13	18	16	2	-	-	7	22	***78***	49	60.3%	**62.8%**	
	PHYS-2B	Lecture	5	6	7	8	1	-	3	9	***39***	27	**46.2%**	69.2%	
	PHYS-3A	Lecture	6	10	4	1	2	-	-	11	***34***	23	58.8%	**67.6%**	
	PHYS-3B	Lecture	13	2	5	-	-	-	1	4	***25***	20	80.0%	80.0%	
	PHYS-99ABC	Independe	1										*100.0%*	*100.0%*	
2010 Total	2010		93	152	130	41	26	1	*26*	116	***585***	443	64.3%	75.7%	
2011	PHYS-11	Lecture	1	24	29	7	10	-	4	16	***91***	71	67.3%	82.3%	
	PHYS-12	Laboratory	23	7	2	-	-	-	1	3	***36***	32	71.4%	71.4%	
	PHYS-1A	Lecture	1	19	26	7	12	-	6	35	***106***	65	**49.6%**	**65.5%**	
	PHYS 1B	Lecture	7	16	13	4	5	-	7	*16*	*68*	45	52.9%	**66.2%**	
	PHYS-1C	Lecture	14	7	22	1	2	-	1	7	***54***	46	73.8%	81.0%	
	PHYS-1D	Lecture	2	3	7	3	3	-	4	9	***31***	18	**44.1%**	**61.8%**	
	PHYS-2A	Lecture	5	11	18	5	4	-	6	29	***78***	43	**47.6%**	**58.3%**	
	PHYS-2B	Lecture	11	10	10	2	1	-	-	9	***43***	34	67.6%	75.7%	
	PHYS-3A	Lecture	5	8	2	-	3	-	1	8	***27***	18	55.6%	**66.7%**	
	PHYS-3B	Lecture	5	17	10	-	-	-	2	3	***37***	32	87.2%	87.2%	
2011 Total	2011		80	122	139	29	40	-	32	135	577	410	59.1%	71.1%	
2012	PHYS-11	Lecture	73	17	25	8	9	-	1	7	***140***	132	66.7%	89.3%	
	PHYS-12	Laboratory	8	-	-	-	-	-	1	2	***11***	8	78.6%	78.6%	
	PHYS-1A	Lecture	11	23	24	8	6	-	2	29	***103***	72	57.1%	70.5%	X
	PHYS-1B	Lecture	9	11	9	1	2	-	1	*1*	*34*	32	85.3%	94.1%	
	PHYS-1C	Lecture	13	11	7	4	3	-	6	12	***56***	38	54.5%	**67.3%**	
	PHYS-1D	Lecture	12	4	12	-	1	-	2	6	***37***	29	66.7%	70.4%	
	PHYS-2A	Lecture	2	25	17	2	6	-	8	11	***71***	52	69.0%	78.2%	
	PHYS-2B	Lecture	18	12	4	-	-	-	1	1	***36***	34	*95.6%*	95.6%	
	PHYS-3A	Lecture	27	12	7	1	2	-	3	6	***58***	49	68.4%	76.3%	
	PHYS-3B	Lecture	7	11	7	-	1	-	-	1	***27***	26	*92.0%*	96.0%	
2012 Total	2012		112	126	112	24	30	-	25	*76*	*505*	404	69.3%	80.0%	

3. Success rates (Discuss your program's rates in light of the college's success rate standard. Set a standard for your program.)
4. Retention rates

RETENTION RATES AND SUCCESS RATES

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The following table shows the physics overall retention rate and success rate:

Year	Spring 2009	Spring 2010	Spring 2011	Spring 2012
Retention	77.2 %	75.7 %	71.1 %	80.0 %
Success	65.1 %	64.3 %	59.1 %	69.3 %

For the previous Program Review the overall retention and success were as follows:

Year	Fall 2005	Fall 2006	Fall 2007	Fall 2008
Retention	70.4 %	68.0 %	70.1 %	66.3 %
Success	58.6 %	59.6 %	58.4 %	52.5 %

The minimum standard of overall success rate for the Physics department is 50%.

Comparing the period from 2005-2008 to the period from 2009-2012, the department has seen improvements in overall retention and overall success. The reason for the improvements remains unclear, but may be due to increased tutoring services and MESA workshops or possibly a different mix of instructors teaching the courses.

Retention Rate per course (census vs. end of course):

Course	Spr. 2009	Spr.2010	Spr. 2011	Spr. 2012
Phys 11	86.6 %	79.3 %	82.3 %	89.3 %
Phys 12	100 %	80.0 %	71.4 %	78.6 %
Phys 1A	63.2 %	74.6%	65.5 %	70.5 %
Phys 1B	Not shown	79.4%	66.2%	94.1%
Phys 1C	87.5%	84.6 %	81.0 %	67.3.0 %
Phys 1D	78.6%	87.5%	61.8%	70.4 %
Phys 2A	69.9 %	62.8 %	58.3 %	78.2 %
Physics 2B	79.2%	69.2%	75.7%	95.6%
Phys 3A	73.1 %	67.6 %	66.7 %	76.3%
Physics 3B	95.7%	80.0%	87.2%	96.0%
Physics Overall	77.2 %	75.3 %	71.7 %	79.0%

Success Rate per course (census vs. received C or better)

Course	Spr. 2009	Spr. 2010	Spr. 2011	Spr. 2012
Phys 11	64.8 %	67.2 %	67.3 %	66.7 %
Phys 12	100 %	80.0 %	71.4 %	78.6 %
Phys 1A	50.0 %	55.4%	49.6 %	57.1 %
Phys 1B	Not	65.1%	52.9%	85.3%
Phys 1C	82.5%	82.1%	73.8%	54.5 %
Phys 1D	60.7%	77.5%	44.1%	66.7 %
Phys 2A	65.4 %	60.3 %	47.6 %	69.0 %
Physics 2B	66.7%	46.2%	67.6%	95.6%
Phys 3A	57.7 %	58.8%	55.6 %	68.4%
Physics 3B	95.7%	80.0%	87.2%	92.0%
Physics Overall	65.1 %	64.2 %	59.9 %	68.2%

OBSERVATIONS:

The table above shows that the retention rates and success rates of the students taking physics varies from semester to semester with no clear trend either up or down

Physics 11: The retention rate for this course is relatively high compared to other physics courses, but the success rate is average. Analysis of the data shows that the proportion of students earning grades of D or F in this course is high. The reason students don't drop the course when they know they are not succeeding is unclear.

Physics 12: The course shows more variability in the retention rate than might be expected. The variability in retention rate is possibly due to small class sizes. Only one section is offered in the spring and no sections are offered in the fall. The retention rate is significantly reduced when only a few additional students drop in such a small class.

Physics 1A: Physics 1A is the course with the lowest retention rate and success rate. Lower retention rates and success rates are expected for this course since it is the first experience many students have with a physics course this rigorous and time- consuming.

Faculty is concerned that many students lose a semester by enrolling in and then dropping Physics 1A and also Physics 2A. One of the reasons that students drop is that sometimes they have weak or distant background in mathematics. Most Physics instructors encourage students to make use of instructors' office hours as well as of the tutoring services offered at the library, online and at MESA. Physics faculty continue to evaluate pedagogical methodology and communicate frequently with colleagues to share ideas on how to present certain topics to students and on how to improve the teaching of those topics. Physics faculty agree that competent teaching requires commitment and hard work on the part of the teacher. Lack of enough time due to over commitment or motivation of students to do the work is another reason for not succeeding in Physics.

Most Physics 1A instructors warn students with a weak background in physics that they are likely to drop the class, and recommend that they take preparatory courses such as Physics 2A, but many students persist in continuing with Physics 1A.

Physics 1B: There was a sharp increase in retention and success rates in spring 2012. The reason for this increase is unclear but could due to the mix of instructors teaching the course.

Physics 1C: There was a sharp decline in retention and success rates in spring 2012. The reason for this decline is unclear but could be due to the mix of instructors teaching the course.

Physics 1D: There was a sharp decline in retention and success rates in spring 2011. The reason for this decline is unclear but could due to the mix of instructors teaching the course.

Physics 2A: There was a decrease in retention and success rate in Physics 2A in spring 2011. . The department has been unable to maintain consistent teaching standards in this course. With the addition of two new full-time physics instructors, we should be able to maintain a high and consistent level of instruction.

Physics 2B: The course shows more variability in the success rate than might be expected with a success rate variation of between 46.2% in spring 2010 and 95.6% in spring 2012. The department has been unable to maintain consistent teaching standards in this course. With the addition of two new full-time physics instructors, we should be able to maintain a high and consistent level of instruction.

Physics 3A and Physics 3B: Success rates for physics 3A is lower than success rate for physics 3B. This is expected since physics 3A is a requisite to physics 3B and students that succeed in physics 3A are expected to be successful in physics 3B.

5. A comparison of success and retention rates in face-to-face classes with distance education classes

The Physics Department does not offer distance education classes.

6. Enrollment statistics with section and seat counts and fill rates

Academic Year	2008-09	2009-10	2010-11	2011-12	4 Yr Average
Annual Section Count	44	41	38	35	39.5
Annual Seat Count	1,411	1,447	1,415	1,235	1,377
Unduplicated Students	1,115	1,113	1,073	945	1,061
Avg Seats/Unduplicated Students	1.27	1.30	1.32	1.31	1.3

SPRING SECTION FILL RATES

	2010	2011	2012	2013
	111.4%	111.0%	104.1%	112.8%

As the data in the above table shows, the demand for physics classes has been very strong for the past four years. Regrettably many students wanting to register for physics classes have been turned away due to the reduction in the number of sections

offered. The courses with the greatest demand are Physics 1A, Physics 2A and Physics 1C. Physics 1A is a prerequisite for Physics 1B, 1C and 1D; Physics 2A is a prerequisite for Physics 2B therefore, increasing the number of sections of Physics 2A and Physics 1A is critical to maintaining a strong program.

7. Scheduling of courses (day vs. night, days offered, and sequence)

Spring Term	2009	2010	2011	2012
Day	65.2%	60.7%	60.3%	63.2%
Night	34.8%	39.1%	39.7%	36.8%
Weekend/Unknown	0.0%	0.2%	37.6%	0.0%

8. Improvement rates (if applicable)
9. Additional data compiled by faculty

DEMAND: FTES BY COURSE/PROGRAM

Course	Maximum number of students per section	Year 1 (Spring 2009)	Year 2 (Spring 2010)	Year 3 (Spring 2011)	Year 4 (Spring 2012)
Physics 11	35	15.16 (four sections)	12.41 (three sections)	11.97 (three sections)	7.95 (two sections)
Physics 12	30	1.91 (one section)	2.12 (one section)	1.49 (one section)	1.49 (one section)
Physics 1A	30	24.43 (three sections)	28.11 (three sections)	24.90 (three sections)	22.60 (three sections)
Physics 1B	30	10.37 (two sections)	11.08 (two sections)	12.00 (two sections)	6.05 (one section)
Physics 1C	30	8.43 (one section)	8.43 (one section)	8.79 (one section)	11.72 (two sections)
Physics 1D	30	5.02 (one section)	7.17 (one section)	5.95 (one section)	4.72 (one section)
Physics 2A	35	28.25 (three sections)	16.78 (two sections)	17.85 (two sections)	18.27 (two sections)
Physics 2B	35	5.31 (one section)	8.28 (one section)	7.86 (one section)	9.56 (one section)
Physics 3A	35	6.75 (one section)	8.52 (one section)	7.00 (one section)	9.26 (one section)
Physics 3B	35	5.76 (one section)	6.25 (one section)	9.50 (one section)	6.25 (one section)
Physics Total:		**111.39**	**109.15**	**107.31**	**97.87**

Course	Maximum number of students per section	Year 1 Spring 2009	Year 2 Spring 2010	Year 3 Spring 2011	Year 4 Spring 2012
Physical Science 25	30	6.90 (one section)	6.68 (one section)	6.90 (one section)	Not offered

b) List any related recommendations.

1) The prerequisites for Physics 1A need to be revised. At this time Physics 2A or 11 with a minimum grade of C or one year of high school physics is required. Faculty believe that having only taken the Physics 11 does not provide with enough background to be successful in Physics 1A.

2) The course outline for Physics 1D will need to be modified to include more modern physics. Physics 1D will now be a 4-unit course instead of a 3-unit course.

3. Curriculum

Review and discuss the curriculum work done in the program during the past four years, including the following:

a) Provide the curriculum course review timeline to ensure all courses are reviewed at least once every 6 years.

As the table below shows, all of our courses have been reviewed within the last four years.

Course Number	Course Title	Course Outline Date
Phys 11	Descriptive Introduction to Physics	May 2009
Phys 12	Laboratory for Introductory Physics	May 2009
Phys 13	Quantitative Aspects of Elementary Physics	Course Deleted
Phys 1A	Mechanics of Solids	Feb 2009
Phys 1B	Fluids, Heat and Sound	Feb 2009
Phys 1C	Electricity and Magnetism	Feb 2009
Phys 1D	Optics and Modern Physics	Feb 2009
Phys 2A	General Physics	March 2013
Phys 2B	General Physics	March 2013
Phys 3A	General Physics with Calculus	Sept 2012
Phys 3B	General Physics with Calculus	Oct 2012

The following table provides the course review timeline for the next three years.

Course Number	Course Title	Course Outline Date
Phys 11	Descriptive Introduction to Physics	Fall 2013
Phys 12	Laboratory for Introductory Physics	Fall 2013
Phys 1A	Mechanics of Solids	Fall 2013
Phys 1B	Fluids, Heat and Sound	Fall 2014
Phys 1C	Electricity and Magnetism	Spring 2015
Phys 1D	Optics and Modern Physics	Spring 2015

b) Explain any course additions to current course offerings.
No courses have been added.

c) Explain any course deletions and inactivations from current course offerings.
Physics 13 has been permanently deleted due to low enrollment.

d) Describe the courses and number of sections offered in distance education. (Distance education includes hybrid courses.)
The Physics Department offers no distance education courses.

e) Discuss how well the courses, degrees, or certificates are meeting students' transfer or career training needs:

1. Have all courses that are required for your program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?
All courses required for the AS-T degree are offered every semester.
2. Are there any concerns regarding program courses and their articulation?
No concerns.
3. How many students earn degrees and/or certificates in your program? Do students take licensure exams? If so, what is the pass rate? If few students receive degrees or certificates or if few students pass the licensure exam, should the program's criteria or courses be re-examined? Set an attainable, measurable goal for future degrees, certificates, and/or licensure pass rates.

The table below shows the number of Physics degrees offered from 2007 to 2012

YEAR	2007-8	2008-9	2009-10	2010-11	2011-2012
Number of physics degrees	3	2	5	3	14

There was a substantial increase in degrees earned in the 2011-2012 school year. Starting in 2012 the number of courses required to obtain a degree was increased. Many of our students show little or no interest in obtaining a degree at the community college level since most are planning on earning a degree at a four-year institution.

f) List any related recommendations.

1) The prerequisites for Physics 1A need to be revised. At this time Physics 2A or 11 with a minimum grade of C or one year of high school physics is required. Faculty believe that the having only taken the Physics 11 does not provide with enough background to be successful in Physics 1A.

2) The course outline for Physics 1D will need to be modified to include more modern physics. Physics will now be a 4-unit course instead of a 3-unit course.

4. Assessment and Student and Program Learning Outcomes (SLOs & PLOs)

a) Provide a copy of your alignment grid, which shows how course, program, and institutional learning outcomes are aligned.

Course SLO Competency alignment						
	Core Competencies Rank each SLO using a scale of 1-4, (1=least important and 4=very important					
	Content Knowledge	Critical Creative and Analytical Thinking	Communication and Comprehension	Professional and Personal Growth	Community and Collaboration	Information and Technology literacy
Physics 11	4	4	2	2	1	2
Physics 12	4	3	2	2	2	1
Physics 1A	4	4	2	2	2	2
Physics 1B	4	4	2	2	2	2
Physics 1C	4	4	2	2	2	2
Physics 1D	4	4	2	2	2	2
Physics 2A	4	4	2	2	2	1
Physics 2B	4	4	2	2	2	1
Physics 3A	4	4	2	2	2	1
	4	4	2	2	2	1

b) Provide a timeline for course and program level SLO assessments.

Calendar Year	Semester	Course-Level SLOs Assessed	Program-Level SLOs Assessed
Year 1 (2014) of 4-Year SLO Cycle *(3 years before Program Review)*	Spring Year 1	SLO #1	PLO #1
	Fall Year 1		
Year 2 (2011) of 4-Year SLO Cycle *(2 years before Program Review)*	Spring Year 2	SLO #2	All courses were assessed
	Fall Year 2		
Year 3 (2013) of 4-Year SLO Cycle *(1 year before Program Review)*	Spring Year 3	SLO #3	No Program-Level SLO assessed
	Fall Year 3		
Year 4 (2013)	Spring		All courses were assessed

of 4-Year SLO Cycle *(Year of Program Review)*	Year 4		
	Fall Year 4		

c) State the percent of course and program SLO statements that have been assessed.

The Physics Department has completed and submitted all required assessments of Student Learning Outcomes for all our courses and all Program Learning Outcomes.

d) Summarize the SLO and PLO assessment results over the past four years and describe how those results led to improved student learning. Analyze and describe those changes. Provide specific examples.

SLOs and PLOs #2 and #3:
Overall students who don't drop our classes do well on SLOs #2 and PLO #2 (Solving Physics Problems), and on SLO#3 and PLO #3 (Data Collection and Analysis). All the courses that were evaluated performed at the desired benchmark or better. To try to reduce the percentage of students dropping physics classes, we must continue to support student learning by continuing to facilitate access to instructors, the MESA program, and the tutoring services online as well as at the LRC. We must include in the assessment of these SLOs and PLOs more challenging problems for students to solve as well as a more challenging data analysis problems than we did the first time we administered SLOs in order to better identify areas in need of improvement.

SLO#1 and PLO#1:

There were significant differences in the scores for this SLO (conceptual questions) from all courses. The courses with the higher score are Physics 1B, Physics 1D, Physics 3A, and Physics 3B.The courses with the lower scores were Physics 2B, Physics 2A and Physics 1A.

As a program, the Physics Program experiences a large drop of students in the Physics 2A and Physics 1A class. It is not surprising that the scores on these courses were among the lowest since the SLO was administered before the drop deadline.
Instructors believe the assessments show that students' understanding of the challenging concepts could be improved. The data suggest that to teach concepts, instructors will need to include more conceptual questions in class, on homework, and on exams. Instructors will meet to discuss ways to improve the teaching of challenging concepts without sacrificing student performance in other important areas of physics such as problem-solving, a crucial part of learning physics.

e) Determine and discuss the level your program has attained in the SLO rubric in Appendix B. (Awareness, Developmental, Proficiency, or Sustainable Continuous Quality Improvement)

1. All instructors are aware of the importance of SLOs and are willing to cooperate and discuss the results of the SLOs.
2. All physics courses have been assessed on each required SLO as scheduled.
3. We are currently in discussions as to how to modify our courses in order improve students' understanding of concepts in physics (SLO #) by including conceptual questions in classes, on homework and on exams. In this way, we are making use of results obtained in SLOs to improve instruction.
4. Laboratory experiments and demonstrations used in class are continually improved and new equipment as well as new demonstrations acquired as funds become available.
5. The overall results of the course level SLOs #2 and #3 along with numerous anecdotal comments from past students indicate that Physics faculty is adequately preparing our successful students in key aspects of problem solving as well as in laboratory work. More challenging problems and laboratory assessments will be included in future SLOs in order to improve instruction in these areas.
6. Faculty members provide students with syllabi in which clear goals are explained in order to help our students understand the purposes of the courses in which they are enrolled.

According to the SLO rubric in Appendix B, the Physics Department is now working at the Proficiency level.

f) Describe how you have improved your SLO process and engaged in dialogue about assessment results.

We have learned from previous SLOs that all faculty needs to be engaged in the development as well as in the assessment of the SLOs. We now are coordinating better with all faculty and are assessing more uniformly all the sections of each class evaluated.

g) **List any related recommendations.**

1. We must include a more challenging problem for students to solve as well as a more challenging data analysis problem than we did the first time we administered SLOs in order to better identify areas in need of improvement.
2. Instructors will need to include more conceptual questions in class, on homework, and on exams to improve the conceptual understanding of physical phenomena by students.

5. Facilities and Equipment

a) Describe and assess the existing program facilities and equipment.

The Physics Department uses four classrooms that are used for lectures as well as for labs. Each classroom has a projector and a computer.

The Physics Department has shop facilities that are used to build, repair, and maintain equipment. We have a wide assortment of lecture demonstration equipment and lab equipment. Some of the equipment has been constructed over the years by our technicians and instructors, and all of the labs are routinely maintained and improved by technicians and instructors. In addition, our technicians sometimes assist other departments in the Natural Sciences Division to repair equipment.

b) Explain the immediate (1-2 years) needs related to facilities and equipment. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

The shop needs water and gas to facilitate maintenance, repairing and construction of equipment. The gas and water lines were severed during renovation and not reconnected. This has been an unacceptable hardship for the technicians.

The following table shows the items needed to improve our facilities:

EQUIPMENT	PURPOSE	COST
Hand Tools (such as corded and cordless drills, router)	Equipment to upgrade the physics shop	$ 1000
Belt sander, small welding set, miter saw, circular saw, good quality hammer drill, router.	Equipment to upgrade the physics shop	$ 2000
Midas Combo Lathe, Mill and Drill (Smithy Industries)	Equipment to upgrade the physics shop	$2200
Band Saw	Equipment to upgrade the physics shop	$2500
Installation of gas and hot and cold water in the shop	To facilitate maintenance, repairing as well as construction of equipment.	$ 7000

c) Explain the long-range (2-4+ years) needs related to facilities and equipment. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

1) Student chairs with wheels.	Some classroom chairs have broken parts. In addition many students have complained that the chairs don't	Variable

	offer back support and are heavy and difficult to move.	

d) **List any related recommendations.**

1. Purchase the items listed above.
2. Install gas and hot and cold water in the shop.

6. Technology and Software

a) Describe and assess the adequacy and currency of the technology and software used by the program.

Each classroom has a projector, and a computer with access to the internet.
The Physics Department would like to have document cameras in all classrooms and possibly smart boards to facilitate teaching and to have ready access to the internet.

b) Explain the immediate (1-2 years) needs related to technology and software. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

1) Document Cameras	**4**	For use by instructors in class presentations instead of chalkboard.	$4000
2) Smart Chalkboard	**1**	To be used by instructors in class presentations instead of chalkboard.	$6000

c) Explain the long-range (2-4+ years) needs related to technology and software. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

1) Laptops or tablets for labs to upgrade current ones.	**32**	For student use	$48000

d) List any related recommendations.

Purchase the items above.

7. Staffing

a) Describe the program's current staffing, including faculty, administration, and classified staff.
The Physics Department has four full-time instructors and part time instructors, one full time technician and one part-time technician

b) Explain and justify the program's staffing needs in the immediate (1-2 years) and long-term (2-4+ years). Provide cost estimates and explain how the position/s will help the program better meet its goals.

Replace full time instructor with other full time instructor in the event that such instructor retire. In particular, Susana Prieto will most likely retire in four and a half years.

c) List any related recommendations.
No recommendations.

8. Future Direction and Vision

a) Describe relevant changes within the academic field/industry. How will these changes impact the program in the next four years?

Modern Physics has become an important part of modern technology and science. The addition of one unit to the Physics 1D course will enable us to teach modern physics with greater depth.

b) Explain the direction and vision of the program and how you plan to achieve it.

Continue to offer the best possible educational opportunities to our students to help them to be successful at transfer four-year institutions and to continue to offer associate degree courses that meet general education requirements.

The following skills will continue to be emphasized in several of our Physics courses so that students have multiple opportunities to learn them throughout their physics experience:

1. Basic knowledge of the major fields of physics
2. Experimental skills:
   Students should have basic experimental skills that include
   a) data collection
   b) notebook recording
   c) data analysis, including error analysis
3. Information handling/problem solving skills.
4. Prioritizing information and gleaning most important points.
5. Scientific method and approach.
6. Organizational skills
7. Ability to handle the rigor and discipline it takes to be a good scientist.

8. Time management, meeting deadlines, focus and staying power, appropriately utilizing other resources, etc.

c) List any related recommendations.

In order to continue offering the best possible education faculty will need to

1. Continue to improve the labs and to make up more interesting labs that can be done with reasonably inexpensive equipment by students with little experience.
2. Continue to identify and replace older or antiquated equipment with more modern equipment.
3. Explore technologies that will enable the instructor to interact more and in a more meaningful way with students
4. Continue to support MESA and help MESA hire more tutors and more skillful ones that are needed to help students who need review work in courses they are enrolled in.
5. Technicians will continue to present newly acquired equipment or demonstrations during department meetings
6. We need to be able to get meaningful statistical information about how our students do after transferring to UC and CSU, in comparison with other transfers.

9. Prioritized Recommendations

a) Provide a single, prioritized list of recommendations and needs for your program/department (drawn from your recommendations in sections 2-8). Include cost estimates and list the college strategic initiative that supports each recommendation (see Appendix A). Use the following chart format to organize your recommendations.

Recommendations	Cost Estimate	Strategic Initiatives
1. Document Cameras (4)	$4000	A and B
2. Millikan Oil Drop Demo (1)	$6000	A and B
3. Hand Tools (such as corded and cordless drills, router)	$1000	
4. X-ray diffraction demo (actually microwaves)	$1600	A and B
5. Laptops or tablets (32) for labs to upgrade current ones.	$48000	A and B
6. Belt sander, small welding set, miter saw, circular saw, good quality hammer drill, router.	$2000	
7. Midas Combo Lathe, Mill and Drill (Smithy Industries)	$2200	
8. Band Saw	$2500	

9. Installation of gas and hot and cold water in the shop	$7000	
10. Student chairs with wheels.	Variable	A and B
11. 2-meter tracks (Pasco, ME-6954)	$1600	A and B
12. 6000g Ohaus Scout Pro Balance WLS-1761-57 (Sargent Welch)	$650	A and B
12. UV source for photoelectric effect demo		A and B
13. Large Capacitor	$400	A and B

b) Ex

Explain why the list is prioritized in this way.

The list was prioritized by consensus of the members of the Physics Department