COMMITTEE ON ACADEMIC PLANNING AND REVIEW
ANNUAL PROGRAM REPORT

College	CoS
Department	Physics
Program Unit	
Reporting for Academic Year	2012-2013
Department Chair	Derek Kimball
Date Submitted	9/13/2013

1. SELF-STUDY (about 1 page)

A. Five-year Review Planning Goals

1. Add Physics 2004 (Modern Physics) to Physics Major/Minor curriculum.
2. Modify Physics Major Mathematics Requirement: add Math 2305 (Calculus IV) and remove Math 4361 (Partial Differential Equations).
3. Capstone projects/class for Physics Majors.
4. Develop Seminar course.
5. Develop Engineering Physics Major.
6. Continue strong General Education offerings.
7. Review/re-design learning objectives and assessment.
8. Maintain a high quality, rigorous offering of physics classes.
9. Provide undergraduate research experiences for all interested majors.
10. Develop and implement a marketing plan for student recruitment.
11. Add TT faculty with specialty in Atomic Physics.
12. Invest in upgraded laboratory equipment for teaching and research.

B. Five-year Review Planning Goals Progress

1. Physics 2004 has been successfully introduced to the Physics major and taught in Fall 2011 and Fall 2012, and has been both popular and successful in better preparing majors for upper division physics.
2. Changes to the Math requirements for the Major have been made.
3. After review of the feasibility of the Capstone projects/course, we have decided to maintain our current Physics 4950 (Capstone) curriculum and allow individual students to complete "capstone-like" projects with faculty members as part of their informal research activities. The Physics 4950 Capstone class now plays a critical role in our summative assessment of physics majors, so we have decided not to re-design it into a project class.
4. We have secured a $25k endowment for our Seminar series and have maintained a strong level

of outside speakers for the Seminars, but to date have decided not to pursue conversion of the series into a course, in part due to the restrictions faced by the Department in regards to the 180 unit cap for all majors. We will continue to discuss the conversion of the seminar into a course but are committed to maintaining a strong seminar series regardless.
5. We have postponed the development of the Engineering Physics major due to the uncertain fiscal climate, but will begin to again pursue its development this academic year.
6. Our General Education course offerings have continued to have strong enrollment, and we have significantly upgraded our Physics 1800 and 1880 (Astronomy) courses and Physics 1700 and 1780 (Elementary Physics) courses.
7. This year we carried out a comprehensive review of our learning outcomes and assessment, developed new learning outcomes and a number of new assessment tools. Full implementation of our assessment plan will be carried out in 2013-14.
8. We have been able to maintain the rigorous nature and high quality of our Physics Major curriculum.
9. All interested undergraduate physics majors have been able to be involved in meaningful research projects with faculty, several leading to regional/national conference presentations and publications in peer-reviewed journals.
10. We will prioritize development of a marketing plan, including a re-design of our Department website, during 2013-14.
11. We have hired Dr. Jennie Guzman who starts in Fall 2013 who specializes in Atomic Physics experiments involving ultracold atoms.
12. With both significant investment from A2E2 and funds raised through teaching self-support courses, we have made major upgrades to laboratory equipment for teaching and research.

C. Program Changes and Needs

(a) Curriculum: In order to continue our progress toward meeting our Five-Year Review Planning Goals, during the 2013-14 academic year we will focus on (1) implementing our Assessment Plan (Goal #7), (2) developing a Physics marketing plan and re-design our Department website (Goal #10), and (3) begin development of an Engineering Physics major (Goal #5).
(b) Resources: Our most pressing need is office space for our new tenure-track faculty member, Dr. Jennie Guzman, who is temporarily sharing a Biology office. We will continue to aggressively pursue internal and external resources for teaching and research.

2. **SUMMARY OF ASSESSMENT (about 1 page)**

A. Program Student Learning Outcomes

Students graduating with a degree in Physics will be able to:
A. Understand the fundamental principles of physics and be able to apply these core ideas to analyze physical processes;
B. Apply quantitative reasoning and critical thinking to solve complex problems, both theoretical and experimental in nature;
C. Independently learn new technical subjects and skills;
D. Design and assemble experiments, quantitatively analyze the results using appropriate statistical procedures and tests of systematic errors, and draw meaningful conclusions;
E. Effectively communicate scientific ideas, both theoretical and experimental, to a variety of audiences through written and oral presentations, both formal and informal;
F. Work effectively as a member of a collaboration to solve problems.

B. Program Student Learning Outcome(s) Assessed

All SLOs were assessed.

C. Summary of Assessment Process

See attached Assessment Report.

D. Summary of Assessment Results

See attached Assessment Report.

3. STATISTICAL DATA (about 1 page)

California State University, East Bay

APR Summary Data

Fall 2008 - 2012

Physics					
	Fall Quarter				
	2008	**2009**	**2010**	**2011**	**2012**
A. Students Headcount					
1. Undergraduate	26	26	20	28	31
2. Postbaccalaureate	0	2	2	1	0
3. Graduate	0	0	0	0	0
4. Total Number of Majors	26	28	22	29	31
	College Years				
B. Degrees Awarded	**07-08**	**08-09**	**09-10**	**10-11**	**11-12**
1. Undergraduate	0	3	2	4	2
2. Graduate	0	0	0	0	0
3. Total	0	3	2	4	2
	Fall Quarter				
	2008	**2009**	**2010**	**2011**	**2012**
C. Faculty					
Tenured/Track Headcount					
1. Full-Time	4	4	4	4	4
2. Part-Time	0	0	0	0	0
3a. Total Tenure Track	4	4	4	4	4
3b. % Tenure Track	50.0%	50.0%	40.0%	40.0%	40.0%
Lecturer Headcount					
4. Full-Time	0	0	0	0	0
5. Part-Time	4	4	6	6	6
6a. Total Non-Tenure Track	4	4	6	6	6
6b. % Non-Tenure Track	50.0%	50.0%	60.0%	60.0%	60.0%
7. Grand Total All Faculty	8	8	10	10	10
Instructional FTE Faculty (FTEF)					
8. Tenured/Track FTEF	3.7	3.5	1.7	3.3	2.8
9. Lecturer FTEF	2.4	2.1	2.7	3.1	3.4
10. Total Instructional FTEF	6.1	5.6	4.3	6.3	6.2
Lecturer Teaching					
11a. FTES Taught by Tenure/Track	57.5	123.4	61.6	77.9	90.0
11b. % of FTES Taught by Tenure/Track	42.8%	60.1%	34.7%	46.1%	42.1%
12a. FTES Taught by Lecturer	76.7	81.9	115.9	91.0	123.9
12b. % of FTES Taught by Lecturer	57.2%	39.9%	65.3%	53.9%	57.9%
13. Total FTES taught	134.2	205.3	177.6	168.9	213.9
14. Total SCU taught	2013.0	3080.0	2663.5	2534.0	3209.0
D. Student Faculty Ratios					
1. Tenured/Track	15.5	35.8	37.0	23.8	32.4
2. Lecturer	32.2	38.4	43.5	29.7	36.4
3. SFR By Level (All Faculty)	22.1	36.8	41.0	26.7	34.6

4. Lower Division	24.1	37.9	44.9	25.4	34.0
5. Upper Division	15.4	33.7	27.5	31.7	36.7
6. Graduate	.	.	.	.	.
E. Section Size					
1. Number of Sections Offered	26.0	33.0	30.0	40.0	39.0
2. Average Section Size	25.6	30.2	35.1	28.4	33.7
3. Average Section Size for LD	27.5	29.7	36.5	28.2	33.7
4. Average Section Size for UD	18.0	32.3	26.8	29.6	34.0
5. Average Section Size for GD	0.0	0.0	0.0	0.0	0.0
6. LD Section taught by Tenured/Track	10	13	11	15	13
7. UD Section taught by Tenured/Track	3	6	3	5	5
8. GD Section taught by Tenured/Track	0	0	0	0	0
9. LD Section taught by Lecturer	10	13	14	16	16
10. UD Section taught by Lecturer	3	1	2	4	5
11. GD Section taught by Lecturer	0	0	0	0	0

Source and definitions available at: http://www.csueastbay.edu/ira/apr/summary/definitions.pdf

DEPARTMENT OF PHYSICS 2012-13 ASSESSMENT REPORT

PHYSICS MAJOR LEARNING OBJECTIVES

Students graduating with a degree in Physics will be able to:

A. Understand the fundamental principles of physics and be able to apply these core ideas to analyze physical processes;
B. Apply quantitative reasoning and critical thinking to solve complex problems, both theoretical and experimental in nature;
C. Independently learn new technical subjects and skills;
D. Design and assemble experiments, quantitatively analyze the results using appropriate statistical procedures and tests of systematic errors, and draw meaningful conclusions;
E. Effectively communicate scientific ideas, both theoretical and experimental, to a variety of audiences through written and oral presentations, both formal and informal;
F. Work effectively as a member of a collaboration to solve problems.

RESULTS

Pre- and post-instruction tests/surveys: (SLOs: A,B,C)

1. Physics 1001 (Force Concept Inventory, FCI, a nationally normed assessment tool)

Overall gain (pre/post test): 30%

(*2011 gain*: 31%; *Studies*: traditional class gain = 23%, active engagement = 48%.)

Overall class average = 51.7%

(*Generally acknowledged threshold for understanding*: average = 60%.)

Subject area breakdown: (not analyzed for 2012)

Kinematics:
1st Law:
2nd Law:
3rd Law:
Vectors:
Forces:

2. Physics 1003 (Baseline E&M Assessment, BEMA, a nationally normed assessment tool)

Overall gain (pre/post test): 29%

(*2012 gain*: N/A; *Studies*: Georgia Tech traditional class gain = 21.9%, Georgia Tech active engagement class gain = 32.9%.)

Overall class average = 46.7%

(*Generally acknowledged threshold for understanding*: average = 60%; *Georgia Tech traditional class* = 47.2%, *Georgia Tech active engagement* = 58.5%)

Subject area breakdown: (not analyzed for 2012)

3. Physics 2004 (Physics GRE-based assessment, Physics GRE-9277, nationally normed)

Not conducted in 2013.

4. Physics 4000 series assessment (see attachment).

5. Physics 4950 (Physics GRE-0177, nationally normed for students applying for graduate school)

Subject area breakdown:

Subject	2013 results	National average
Classical mechanics:	23.9	51.6
Electromagnetism:	26.9	48.2
Optics:	19.8	39.8
Thermodynamics:	21.4	51.9
Quantum:	11.1	45.4
Atomic:	28.6	52.1
Special relativity:	9.3	38.8
Laboratory methods:	38.9	38.5
Special topics:	20.0	38.8

An aspirational goal for the Department is for our students to achieve the national average. In only one subject was this achieved in 2013 (Laboratory methods). A majority of the students taking the course were Juniors who had not yet taken Classical Mechanics or Quantum Mechanics, and so assessment of this curriculum is somewhat limited. Nonetheless there appears to be much work to be done across the board on all subjects. Once we acquire data for Physics 2004 students we will be able to better gauge student improvement as they proceed through the major.

Problem Sets and In-class Problems (individual & group, rubric-based assessment): (SLOs: A,B,C,E,F)

1. Physics 2004

Not conducted in 2012.

2. Physics 3302

Course not taught in 2013.

3. Physics 4002

Not conducted in 2012.

Experiment with Presentation, Lab Notebook write-up (rubric-based): (SLOs: A,B,C,D,E,F)

1. Physics 1001 (Lab notebook only)

Not conducted in 2012.

2. Physics 2004

Not conducted in 2012.

3. Physics 3281/3283

Laboratory Notebook (goal is an average of 4.0 or above in each area):

Evaluation area	2013 results	2012 results
Description of work:	4.5	N/A
Data:	4.2	N/A
Data analysis:	4.4	N/A
Curiosity:	4.1	N/A
Predictions/Models:	4.0	N/A
Timing:	4.5	N/A

The assessment indicates that in the area of experimental techniques and laboratory notebook write-up, our students are successfully meeting our SLOs.

Presentation (goal is an average of 4.0 or above in each area):

Evaluation area	2013 results	2012 results
Outline/introduction:	3.9	N/A
Experimental setup/procedure:	4.1	N/A
Results/discussion:	3.2	N/A
Conclusion:	5.0	N/A
Questions/answers:	3.6	N/A
Presentation quality:	4.7	N/A

Our assessment indicates that the oral presentation skills of our students are strong indicating our students are successfully meeting SLO E, however our students are below our target in three areas. All areas where students are below target relate to the students' deeper understanding of the physics involved in the experiments, a weakness reflected in part on the students' performance on the Capstone Exam (PHYS 4950) assessment. This indicates further work is required to help our students meet SLOs A, B, and C.

SUMMARY

During the 2012-13 academic year the Physics Department developed new Physics Major/Minor SLOs, a new Assessment Plan, and a Curriculum Map. These efforts were essential in clarifying what we expect of our students and what the focus of our curriculum should be. Our Assessment Plan was only partially implemented in 2012-13, and we plan full implementation in 2013-14. This should enable a fuller perspective on our progress and areas that need attention.

On September 12, 2013, the Department held a meeting of tenure-track and lecturers with 3-year appointments to discuss the assessment results, teaching strategies, and our curriculum. This will become an annual meeting.

During the meeting, we identified several areas to focus on with regards to SLOs and assessment during the 2013-14 academic year:

(1) Consider modifying Physics Major SLOs (E) and (F) to include consideration of diversity. Implementation of this SLO modification could be done, at least initially, through including statements on diversity and inclusion in our course syllabi and conducting faculty training in terms of being allies for diverse students in the classroom environment.

(2) Develop SLOs and assessment plan for Physics 2700 series (our algebra-based physics sequence).

(3) Modify/revise the laboratory rubric for assessment of Physics 1001, 2004, and 3281/3 laboratory experiences.

(4) Break down results of the Force Concept Inventory (FCI) and Baseline Electromagnetism Assessment (BEMA) by subject.

(5) Carry out problem set, in-class problem presentation, and exam solution assessment in Physics 2004 and 3302.

Our overall assessment of the Physics curriculum is that our students appear to be achieving success in meeting SLOs (D), (E), and (F), while they are falling somewhat short of our Department's goals for their performance related to SLOs (A), (B), and (C). The Department felt that at this time, SLO (B) had not been adequately assessed, and this would be carried out during 2013-14 through our problem-solving assessment.

In the Physics 1000 series (our calculus-based General Physics sequence), the students are performing admirably at meeting SLOs (A) and (C) as judged from the nationally normed FCI and BEMA. The Physics GRE used as the assessment tool in our Capstone course (Physics 4950) tests different skills, however, requiring students to solve relatively complicated and subtle physics problems often involving mathematical calculations, assessing SLO (B). Therefore a better sense of the physics majors overall performance in their early careers will be achieved with the implementation of the GRE-based assessment in Physics 2004 during 2013-14. Regardless, we hope to adapt the successful strategies employed in Physics 1000 series throughout the upper division curriculum to enhance student learning.

Assessment of SLOs for the upper division electromagnetism course (Physics 4000 series) demonstrated impressive gains (see attachment). This is somewhat in contrast to the GRE performance in the Capstone class. This may indicate that retention of core physics concepts and skills is short-term and focused on the classes intensively studied, but more difficult to apply more broadly to physical problems in general. There is a sense in the Department that students may not be adequately developing the "intuitive sense of physics" with a strong grasp of basics and fundamentals that is necessary for solving the broad range of problems the GRE assesses, or that are faced in real-life laboratory situations where knowledge of all subject areas is simultaneously drawn upon.

There was a lengthy discussion about how to address this in the curriculum. Several ideas were suggested which will be piloted in 2013-14:

(a) Focus some larger part of problem sets and exams at the upper division level on concepts and fundamentals to reinforce these ideas.

(b) Introduce more "conceptual conversations" into upper division courses.

(c) Expand use guided reading questions to encourage/train students to carefully read and try to understand upper division texts.

(d) Implement a journal club to encourage physics discussions, perhaps through our Selected Topics (Physics 4250) course.

(e) Use active engagement methods at all levels to improve student learning.