CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ACADEMIC SENATE

ACADEMIC PROGRAMS COMMITTEE

REPORT TO

THE ACADEMIC SENATE

AP-031-156

Physics, B.S. — General Option

General Education Committee	**Date: 5/15/2016**
Executive Committee **Received and Forwarded**	**Date: 5/17/16**
Academic Senate	**Date: 5/25/16** **First Reading** **06/01/2016** **Second Reading**

BACKGROUND: The Department of Physics and Astronomy is proposing revisions to its Bachelor of Science in Physics, to be offered under semesters. The revisions to the program place greater emphasis on fundamental concepts, laboratory skills, and computational skills. Originally this was just a standalone program, not an Option, but with proposals for two new Options from the Department, it is being referred to as an Option here. Since it is the most flexible of the Options put forward by the Department, it is referred to as the "General Option" per the terminology of AS-2465-145/AP.

RESOURCES CONSULTED:
Faculty
Department Chairs
Associate Deans
Deans
Office of Academic Programs

DISCUSSION:
Before reaching the Academic Programs Committee, this program was reviewed by the College Curriculum Committee in the College of Science as well as the Dean of Science and the Office of Academic Programs. The Academic Programs Committee then conducted campus-wide consultation, as well as its own review of the program. No comments were received by the Academic Programs Committee.

RECOMMENDATION:

The Academic Programs Committee recommends approval of the General Option under the Bachelor of Science in Physics.

Learning outcomes

Classes	1a: Identify physical quantities	1b: Identify appropriate equations	1c: Use symmetry	1d: Obtain real-world predictions from models	1e: Use foundational theories	2a: Estimation	2b: Analytical techniques	2c: Proportional reasoning	2d: Computation	3a: Set up experiments or computations	3b: Uncertainty	3c: Data analysis	4a: Written communication	4b: Spoken communication
PHY 1510: Newtonian Mechanics	I	I	I	I	I	I	I	I						
PHY 1510L: Newtonian Mechanics Lab						I		I		I	I	I	I	I
PHY 1520: E&M	I	I	I	I	I	I	I	I						
PHY 1520L: E&M Lab						I		I		I	I	I	I	I
PHY 2530: EM waves & relativity	D	D	D	D	D	D	D	D						
PHY 2530L: EM waves & relativity lab						D		D		D	D	D	D	D*
PHY 2540: Thermo & QM	D	D	D	D	D	D	D	D						
PHY 2540L: Thermo & QM lab						D		D		D	D	D	D	D*
MAT 2010: Numerical Methods									I					
PHY 3040: Electronics	D	D	D	D	D	D	D	D						
PHY 3040L: Electronics lab						D		D		D	D	D	D	D*
AST 3240: Observational Astronomy	D	D		D	D	D	D	D						
AST 3240A: Observational Astronomy Computer Activity						D		D		D	D	D	D	D*
PHY 3210: Mechanics	D	D	D	D	D	D	D	D	D					
PHY 3440: Applied Optics	D	D	D	D	D	D	D	D						
PHY 3440A: Applied optics computational activity						D			D			D	D	D*
PHY 3600: Math methods	D	D	D	D	D	D	D	D						
PHY 4010: Quantum	M	M	M	M	M	M	M	M						
PHY 4090: Computational	M	M	M	M	M	M		M	M	M	M	M	M	M*
PHY 4140: E&M	M	M	M	M	M	M	M	M						
PHY 4170: Wave optics	M	M	M	M	M	M	M	M						
PHY 4170L: Wave optics lab						M		M		M	M	M	M	M*
PHY 4330: Thermo	M	M	M	M	M	M	M	M						
PHY 4510 A/L: Adv. Lab 1						M		M		M	M	M	M	M*
PHY 4520 A/L: Adv. Lab 2						M		M		M	M	M	M	M*
PHY 4630: Seminar				M		M		M				M	M	M*

*When applicable; instructor-dependent

Learning outcomes

Classes	1a: Identify physical quantities	1b: Identify appropriate equations	1c: Use Biological Principles	1d: Obtain real-world predictions from models	1e: Use foundational theories	2a: Estimation	2b: Analytical techniques	2c: Proportional reasoning	2d: Computation	3a: Set up experiments or computations	3b: Uncertainty	3c: Data analysis	3d: Biology and biochemistry lab proficiency	4a: Written communication	4b: Spoken communication
PHY 1510: Newtonian Mechanics	I	I		I	I	I	I	I							
PHY 1510L: Newtonian Mechanics Lab						I		I		I	I	I		I	I
PHY 1520: E&M	I	I		I	I	I	I	I							
PHY 1520L: E&M Lab						I		I		I	I	I		I	I
PHY 2530: EM waves & relativity	D	D		D	D	D	D	D							
PHY 2530L: EM waves & relativity lab						D		D		D	D	D		D	D*
PHY 2540: Thermo & QM	D	D		D	D	D	D	D							
PHY 2540L: Thermo & QM lab						D		D		x	x	x		x	D*
BIO 1210, 1220: Intro bio principles			I												
BIO 1210l, 1220L: Intro bio labs													I		
MAT 2010: Numerical Methods									I						
PHY 3040: Electronics	D	D		D	D	D	D	D							
PHY 3040L: Electronics lab						D		D		D	D	D		x	D*
PHY 3440: Applied Optics	D	D		D	D	D	D	D							
PHY 3440A: Applied optics computational activity						D			D			D		D	D*
PHY 3600: Math methods	D	D		D	D	D	D	D							
PHY 4090: Computational	M	M		M	M	M		M	M	M	M	M		M	M*
PHY 4100: Biophysics	M	M	D	M	M	M	M	M	D*			M		M	M*
PHY 4170: Wave optics	M	M		M	M	M	M	M							
PHY 4170L: Wave optics lab						M		M		M	M	M		M	M*
PHY 4330: Thermo	M	M		M	M	M	M	M							
Physics theory electives	M	M		M	M	M	M	M							
PHY 4510 A/L and/or PHY 4520 A/L:						M		M		M	M	M		M	M*
PHY 4610/4620: Senior project (if project topic is biophysical)	M*	M*	M	M*	M*	M	M	M	M*	M	M	M	M*	M	
PHY 4630: Seminar			M*	M		M		M				M		M	M*
Advanced bio/chem lectures			D			M		M							
Advanced bio/chem labs			D			D		D	D*	D	D	D	D	D	D*

*When applicable; instructor-dependent

Learning outcomes

Classes	1a: Identify physical quantities	1b: Identify appropriate equations	1c: Obtain real-world predictions from models	1d: Use foundational theories of physics	1e: Describe foundational principles of biology, chemistry, & geology	2a: Estimation	2b: Analytical techniques	2c: Proportional reasoning	2d: Computation	3a: Set up experiments or computations	3b: Uncertainty	3c: Data analysis	4a: Written communication	4b: Spoken communication	5a: Integrate content and pedagogy	5b: Observe phenomena & develop explanations	5c: Use explanations to make predictions	5d: Evaluate experimental outcomes	5e: Represent physical processes multiple ways
PHY 1510: Newtonian Mechanics	I	I	I	I		I	I	I									I		I
PHY 1510L: Newtonian Mechanics Lab						I		I		I	I	I	I	I		I	I	I	I
PHY 1520: E&M	I	I	I	I		I	I	I									I		I
PHY 1520L: E&M Lab						I		I		I	I	I	I	I		I	I	I	I
PHY 2530: EM waves & relativity	D	D		D		D	D	D									D		D
PHY 2530L: EM waves & relativity lab						D		D		D	D	D	D	D*		D	D	D	D
PHY 2540: Thermo & QM	D	D		D		D	D	D									D		D
PHY 2540L: Thermo & QM lab						D		D		D	D	D	D	D*		D	D	D	D
MAT 2010: Numerical Methods									I										
PHY 3040: Electronics	D	D		D		D	D	D											D
PHY 3040L: Electronics lab						D		D		D	D	D	D	D*		D	D	D	
PHY 3210: Mechanics	D	D	D	D		D	D	D	D										D
AST 3240: Observational Astronomy	D	D		D		D	D	D								D	D	D	D
AST 3240A: Observational Astronomy Computer Activity						D		D		D	D	D	D	D*		D	D	D	D
PHY 3440: Applied Optics	D	D	D	D		D	D	D											D
PHY 3440A: Applied optics computational activity						D			M			D	D	D*		D	D		D
PHY 3600: Math methods	D	D		D		D	D	D											
PHY 4090: Computational	M	M		M		M		M	M	M	M	M	M	M*					M
PHY 4100: Biophysics	M	M	M	M	D	M	M	M	D*			M	M	M*		M	M	M	M
PHY 4170: Wave optics	M	M		M		M	M	M											M
PHY 4170L: Wave optics lab						M		M		M	M	M	M	M*		M	M	M	M
Physics theory electives	M	M		M		M	M	M											M
PHY 4510 A/L and/or PHY 4520 A/L:						M		M		M	M	M	M	M*		M	M	M	
PHY 4610/4620: Senior project (for relevant project topics)	M*	M*	M	M*	M*	M	M*	M	M*	M	M	M	M	M	M	M			M
PHY 4630: Seminar					M										D				

Teaching Experience														I, D				
BIO 1210					I													
BIO 1210L					I													
BIO 1220					I													
BIO 1220L					I													
CHM 1210					I													
CHM 1210L					I													
CHM 1220					I													
CHM 1220L					I													
GSC 1110: Principles of Geology					I													
GSC 1140: Principles of Geology Laboratory					I													
GSC 1160: Astronomy					I													

*When applicable; instructor-dependent

Physics, B.S. - General Option: 120 units

I. Program - Q2S Existing Program/Option/Minor

General Catalog Information

****READ BEFORE YOU BEGIN****

1. **Turn the help text on by clicking on the following icon .**
2. **All fields with an asterisk (*) are required fields. If left blank, the request will not be launched and cannot be acted upon.**
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Department	**Physics and Astronomy**
Conversion Category:*	(•) Revisioned ( ) Directly Converted
Proposal Type:*	(•) Program ( ) Option ( ) Minor
Describe or list changes*	Bachelor of Science in Physics Key changes: 1) Sophomore sequence expanded from 2 quarters (PHY 234, 235) to a full year (PHY 2530, 2540). 2) Expand the number of units (after allowing for conversion) in upper-division labs to emphasize technical and data analysis skills. 3) Convert upper-division lecture courses on theoretical physics to lecture+activity to allow more opportunities for active learning.
Semester Program Name (e.g. Biology, B.S., Art History, B.A.)	Physics, B.S. - General Option: 120 units
Program Description	The purpose of the B.S. in Physics (General Option) is to provide students with both broad and deep training in physics. This is further elaborated in the Mission Statement and Program Objectives that are included with the Assessment Plan below.

Revisioned Program Deliverables:

1. **Curriculum Sheet**
2. **Road Map**
3. **Two-Year Course Offering**
4. **Assessment Plan**

Directly Converted Program Deliverables:

1. **Curriculum Sheet**
2. **Road Map**
3. **Two-Year Course Offering**

Revisioned/Directly Converted Minor Deliverables:

1. **Curriculum Sheet**
2. **Road Map**

Either enter or paste into the following fields or attach by clicking .

Curriculum Sheet

CURRICULUM SHEET

CURRICULUM SHEET FOR SEMESTER CONVERSION

	Program Name: Bachelor of Science in Physics—General Physic
	Total Units (Major [including option/emphasis]+GE-Double Co
	Major Courses – Core – Units: 45

Course Number	**Title**
CHM 1210/1210L	General Chemistry 1
MAT 1140	Calculus I
MAT 1150	Calculus II
MAT 2140	Calculus III

MAT 2250	Linear Algebra with Applications to Differential Equations
MAT 2010	Introduction to Computational Methods in Mathematics
PHY 1510/1510L	Introduction to Newtonian Mechanics
PHY 1520/1520L	Introduction to Electromagnetism and Circuits
PHY 2530/2530L	Introduction to Electromagnetic Radiation and Special Relativ
PHY 2540/2540L	Introduction to Thermal and Quantum Physics
PHY 3600/3600A	Mathematical Methods of Physics 1
PHY 4630	Senior seminar

Major Courses – Core Electives – Units: None

Option Courses – Units: 16

Course Number	Title
PHY 3210/A	Advanced Classical Mechanics
PHY 4010/A	Quantum Mechanics 1
PHY 4140/A	Electricity and Magnetism 1
PHY 4330/A	Thermal and Statistical Physics

Option Electives: 14 units

Course Number	Title
A minimum of 7 units must be selected from the following list, with the proviso that LEAST 2 units from PHY 4510L/4510A/4520L/4520A:	
AST 3240/A	Observational Astronomy
PHY 3040/3040L	Electronics for Scientists
PHY 4090/4090A	Computational Physics
PHY 4170/4170L	Wave Optics
PHY 4410	Internship in Physics
PHY 4510L	Advanced Laboratory Physics—Advanced Instrumentation
PHY 4520L	Advanced Laboratory Physics—Contemporary Experiments
PHY 4610/4620	Senior Project
The remaining elective units may be selected from any upper-division PHY or AST co AST 3420, PHY 3010, and PHY 3020) or other upper-division math, science, and eng by the department.	

GE units not double-counted: 42 (Areas A1, A2, A3, B2, B5, C1, C2, C3, C4, D1, D2, D3, D4, E)

Unrestricted electives: 3

Roadmap

Department: Physics and Astronomy

Physics Major-General Physics Option

Curriculum Year: 2018-2019

Your department has developed this road plan, taking into account prerequisites and schedule restrictions.

Students should pay attention to these concerns when deviating from this plan.

Total Units:	**120**	
	Option Core	
	Option Electives	
	GE	
	Major Core	
Year 1: Fall		
Course	**Description**	**Units**
MAT 1140	Calculus I (GE Area B4)	4
CHM 1210/L	General Chemistry I (GE Area B1&B3)	4
SCI 1010/A	Freshman Experience I (Partial GE Area E)	2
ENG ???	Composition Course (GE Area A1)	3
	Total	**13**
Year 1: Spring		
Course	**Description**	**Units**
MAT 1150	Calculus II	4
PHY 1510/L	Introduction to Newtonian Mechanics	4
SCI 1020	Freshman Experience II (Complete GE Area E)	1
LD GE 5	Any lower-division course in GE Area A, B2, C, or D	3
LD GE 6	Any lower-division course in GE Area A, B2, C, or D	3
	Total	**15**
Year 2: Fall		
Course	**Description**	**Units**
MAT 2140	Calculus III	4
PHY 1520/L	Introduction to Electromagnetism & Circuits	4
LD GE 7	Any lower-division course in GE Area A, B2, C, or D	3
LD GE 8	Any lower-division course in GE Area A, B2, C, or D	3
LD GE 9	Any lower-division course in GE Area A, B2, C, or D	3
	Total	**17**

Year 2: Spring		
Course	**Description**	**Units**
MAT 2010	Introduction to Computational Methods in Mathematics	4
MAT 2250	Linear Algebra with Applications to Differential Equations	4
PHY 2530/L	Introduction to Electromagnetic Radiation and Special Relativity	4
LD GE 10	Any lower-division course in GE Area A, B2, C, or D	3
	Total	**15**
Year 3: Fall		
Course	**Description**	**Units**
PHY 2540/L	Introduction to Thermal & Quantum Physics	4
PHY 3600/A	Mathematical Methods of Physics 1	4
LD GE 11	Any lower-division course in GE Area A, B2, C, or D	3
LD GE 12	Any lower-division course in GE Area A, B2, C, or D	3
	Total	**14**
Year 3: Spring		
Course	**Description**	**Units**
PHY 3210/A	Advanced Classical Mechanics	4
PHY 4140/A	Electricity and Magnetism 1	4
LD GE 13	Any lower-division course in GE Area A, B2, C, or D	3
PHY ???	PHY Electives	4
	Total	**15**
Year 4: Fall		
Course	**Description**	**Units**
PHY 4330/A	Thermal and Statistical Physics	4
PHY 4010/A	Quantum Mechanics 1	4
PHY ???	PHY Electives	4
Synthesis 1	Any course in GE Area B5, C4, or D4	3
	Total	**15**
Year 4: Spring		
Course	**Description**	**Units**
PHY 4630	Senior Seminar	1
PHY ???	PHY Electives	6
Synthesis 2	Any course in GE Area B5, C4, or D4	3
Synthesis 3	Any course in GE Area B5, C4, or D4	3
	Free elective	3
	Total	**16**

Two-Year Course Offering **Physics and Astronomy Projected Two-Year Course Schedule**

Please refer to BroncoDirect for the current academic quarter course schedule

Prefix	Number	Title	Un
AST	1010	Stars, Galaxies, and the Universe	3
AST	2000	Special Study for Lower-Division Students	1-2
AST	2990/2990A/2990L	Special Topics for Lower-Division Students	1-3
AST	3050	Archaeoastronomy	3
AST	3240	Observational Astronomy	2
AST	3240A	Observational Astronomy Computer Activity	1
AST	3420	Life, the Universe, and Everything	3
AST	4000	Special Study for Upper-Division Students	1-2
AST	4240	Astrophysics I: Stars and Planetary Systems	3
AST	4240A	Astrophysics I Recitation	1
AST	4250	Astrophysics II: Galaxies and the Universe	3
AST	4250A	Astrophysics II Recitation	1
AST	4610	Senior Project 1	1
AST	4620	Senior Project 2	2
AST	4990/4990A/4990L	Special Topics for Upper-Division Students	1-3
PHY	1020	Fundamentals of Physics	3
PHY	1050	The Physics of Musical Sound	2
PHY	1050L	Physics of Musical Sound Laboratory	1
PHY	1210	Physics of Motion, Fluids, and Heat	3
PHY	1210L	Laboratory on Motion, Fluids, and Heat	1
PHY	1220	Physics of Electromagnetism, Circuits, and Light	3
PHY	1220L	Laboratory on Electromagnetism, Circuits, and Light	1
PHY	1510	Introduction to Newtonian Mechanics	3
PHY	1510A	Newtonian Mechanics Recitation	1
PHY	1510L	Newtonian Mechanics Laboratory	1
PHY	1520	Introduction to Electromagnetism and Circuits	3

PHY	1520A	Electromagnetism and Circuits Recitation	1
PHY	1520L	Introductory Laboratory on Electromagnetism and Circuits	1
PHY	2000	Special Study for Lower-Division Students	1-2
PHY	2120	Physics for Elementary Educators	2
PHY	2120L	Physics for Elementary Educators Lab	1
PHY	2530	Introduction to Electromagnetic Radiation and Special Relativity	3
PHY	2530A	Electromagnetic Radiation and Special Relativity Recitation	1
PHY	2530L	Introductory Laboratory on Electromagnetic Radiation and Special Relativity	1
PHY	2540	Introduction to Thermal and Quantum Physics	3
PHY	2540A	Thermal and Quantum Physics Recitation	1
PHY	2540L	Introductory Laboratory on Thermal and Quantum Physics	1
PHY	2990/2990A/2990L	Special Topics for Lower-Division Students	1-3
PHY	3010	Energy and Society	3
PHY	3020	Physics for Future Presidents	3
PHY	3040	Electronics for Scientists	2
PHY	3040L	Electronics for Scientists Laboratory	1
PHY	3060	History of Physics	3
PHY	3210	Advanced Classical Mechanics	3
PHY	3210A	Advanced Classical Mechanics Recitation	1
PHY	3440	Applied Optics	2
PHY	3440A	Computational Activities in Applied Optics	1
PHY	3600	Mathematical Methods of Physics 1	3
PHY	3600A	Mathematical Methods of Physics Recitation	1
PHY	3610	Mathematical Methods of Physics 2	3
PHY	4000	Special Study for Upper-Division Students	1-2
PHY	4010	Quantum Mechanics 1	3
PHY	4010	Biophysics	3
PHY	4010A	Quantum Mechanics 1 Recitation	1
PHY	4020	Quantum Mechanics 2	3
PHY	4040	Introduction to High Energy Physics	3
PHY	4060	Introduction to Condensed Matter Physics	3
PHY	4090	Computational Physics	2
PHY	4090A	Computational Physics Activity	1

PHY	4140	Electricity and Magnetism 1	3
PHY	4140A	Electricity and Magnetism 1 Recitation	1
PHY	4150	Electricity and Magnetism 2	3
PHY	4170	Wave Optics	2
PHY	4170L	Wave Optics Laboratory	1
PHY	4220	Plasma Physics	3
PHY	4330	Thermal and Statistical Physics	3
PHY	4330A	Thermal and Statistical Physics Recitation	1
PHY	4410	Internship in Physics	1-2
PHY	4510A	Advanced Laboratory Physics - Advanced Instrumentation Recitation	1
PHY	4510L	Advanced Laboratory Physics - Advanced Instrumentation	1
PHY	4520A	Advanced Laboratory Physics - Contemporary Experiments Recitation	1
PHY	4520L	Advanced Laboratory Physics - Contemporary Experiments	1
PHY	4610	Senior Project 1	1
PHY	4620	Senior Project 2	2
PHY	4630	Senior Seminar	1
PHY	4990/4990A/4990L	Special Topics for Upper-Division Students	1-3

Assessment Plan

MISSION AND VISION STATEMENTS FOR THE

PHYSICS MAJOR: GENERAL OPTION

Mission:

The mission of the General Physics Option is to provide students with rigorous preparation for a wide variety of careers and advanced programs of study in physics and its applications, including basic and applied research, careers in high-technology industries, and science education.

Program Objectives:

1. Students will learn and be able to apply the basic principles of foundational theories of physics to develop models of fundamental phenomena and technologically relevant processes in the real world.

2. Students will be able to use common mathematical and computational techniques to obtain quantitative predictions from models.
3. Students will be able to work with experimental apparatus to make accurate physical measurements, will be able to identify the limitations of various measuring devices, and will be able to quantify the systematic and statistical uncertainties in their experimental results.
4. Students will be able to communicate an understanding of fundamental physics principles, of problem solving strategies, and of analyses of experimental data and the inherent uncertainties, in both written and oral forms.
5. Physics majors, upon graduation, will be prepared for careers in teaching, research, industry, or public service, as well as advanced study in physics and related fields.

Student Learning Outcomes:

We have designed the student learning outcomes to be closely aligned with the program objectives:

Area 1: Physical Principles

LO 1a: Students will be able to identify the appropriate physical quantities to solve for when given information on a physical system and asked to predict its behavior.

LO 1b: Students will be able to identify the appropriate equations to apply for modeling a system, and will be able to state the reasons why those equations are necessary and others are not.

LO 1c: Students will be able to use symmetry to simplify equations and models.

LO 1d: Students will be able to use physics models to obtain quantitative predictions for real-world technologies and problems. Examples may include energy issues, medical devices, and information technology.

LO 1e: In developing these models, students will be able to draw upon key foundational theories of physics, including Newtonian mechanics, the theory of relativity, electromagnetism, quantum mechanics, thermodynamics, and statistical mechanics.

Area 2: Theoretical and mathematical skills:

LO 2a: Students will be able to use estimation techniques and dimensional analysis to obtain quantitative predictions from simple models of a physical system, with the goal of getting estimates that are accurate to within an order of magnitude.

LO 2b: Students will be able to apply standard analytical techniques for the solution of ordinary and partial differential equations to solve common physics equations in situations that are relevant to the real world.

LO 2c: Students will be able to use proportional reasoning and dimensional analysis to check analytical solutions, and to predict the qualitative behavior of physical systems.

LO 2d: Students will be able to use computer tools to solve physically relevant problems that are not amenable to exact solutions.

Area 3: Experimental and technological skills

LO 3a: Students will be able to set up and troubleshoot components of experimental and/or computational tools in order to perform a measurement or simulation of a physically relevant quantity or phenomenon.

LO 3b: Students will be able to quantitatively describe the limitations of their experimental apparatus or algorithm, and use information on those limitations to determine uncertainties in measured quantities or precision of computed quantities.

LO 3c: Students will be able to analyze experimental or simulation data and compare the results of the data analysis with predictions from physical theories.

Area 4: Professional Communication Skills

LO 4a: Students will be able to write professional-quality reports that describe the methods, results, and interpretation of experimental or computational investigations of physics problems.

LO 4b: Students will be able to give verbal presentations on physical principles, applications of physical principles, and the results of physics investigations, at a level understandable by an audience of novices. These presentations may include visual aids.

Curriculum Matrix: We will collect evidence for assessment of learning outcomes from (1) courses required of all students in this program and (2) relevant electives taken by a large portion of the students in the program. Core courses are listed in **bold red**, and elective courses are listed in *gray italics*. We are leaving out activity courses that are designed primarily to reinforce concepts from lecture, but are including selected activity courses that include significant hands-on projects.

Methods of Assessment:

The committee responsible for assessment will request the following from instructors of relevant courses:

1. Copies of questions, problems, and assignments that are particularly useful for assessing the program's learning outcomes.
2. A summary (including scores, grades, or other quantitative results) of class performance on those assignments, problems, etc. in the past year (including both the average and the range).
3. Examples of student work that highlight areas of particularly common strengths and weaknesses.

Classes	1a: Identify physical quantities	1b: Identify appropriate equations	1c: Use symmetry	1d: Obtain real-world predictions from models	1e: Use foundational theories	2a: Estimati
PHY 2530: EM waves & relativity	x	x	x	x	x	x
PHY 2530L: EM waves & relativity lab						x
PHY 2540: Thermo & QM	x	x	x	x	x	x
PHY 2540L: Thermo & QM lab						x
PHY 3040: Electronics	x	x	x	x	x	x
PHY 3040L: Electronics lab						x
AST 3240: Observational Astronomy	x	x		x	x	x
AST 3240A: Observational Astronomy Computer Activity						x
PHY 3210: Mechanics	x	x	x	x	x	x
PHY 3440: Applied Optics	x	x	x	x	x	x
PHY 3440A: Applied optics computational activity						x
	x	x	x	x	x	x

PHY 3600: Math methods						
PHY 4010: Quantum	x	x	x	x	x	x
PHY 4090: Computational	x	x	x	x	x	x
PHY 4140: E&M	x	x	x	x	x	x
PHY 4170: Wave optics	x	x	x	x	x	x
PHY 4170L: Wave optics lab						x
PHY 4330: Thermo	x	x	x	x	x	x
PHY 4510 A/L: Adv. Lab 1						x
PHY 4520 A/L: Adv. Lab 2						x
PHY 4630: Seminar				x		x
						*When applicab instructc depende

Timeline of Assessment:

In order to align our assessment efforts with the five year planning and program review cycle, and to synchronize assessment of courses with similar learning outcomes, we plan to collect and analyze evidence relating to each learning objective twice in a five year cycle. All courses mentioned below are those listed on the Curriculum Matrix above.

Year	Data Collection	Key Learning Outcomes	Action/Plans
1	Lecture/discussion courses without accompanying labs	LO 1a-1e, 2a-2c (Concepts, principles, and theories)	• Presentation to department.

			• Evaluation in light of previous 5 year review. • Plans for near-term improvements.
2	Lab and activity classes, and senior seminar	LO 2d, 3a-3c, 4a-4b (Laboratory, technological, and professional skills)	• Presentation to department. • Evaluation in light of previous 5 year review. • Plans for near-term improvements.
3	Lecture/discussion courses without accompanying labs	LO 1a-1e, 2a-2c (Concepts, principles, and theories)	• Presentation to department. • Evaluation in light of year 1 plans. • Begin planning more substantial changes and improvements.
4	Lab and activity classes, and senior seminar	LO 2d, 3a-3c, 4a-4b (Laboratory, technological, and professional skills)	• Presentation to department. • Evaluation in light of year 1 plans. • Begin planning more substantial changes and improvements.
5	Summary of years 1-4, and additional data for areas identified as needing further analysis.		• Evaluation of past years of effort. • Evaluate effectiveness of attempts to improve. • Reconsider program objectives. • Plan changes for future.

The following fields are for integration purposes with the University Catalog (i.e. Acalog e-catalog). Please select Program and leave Curriculum blank.

Select Program ◉ Program
○ Shared Core

Prospective Curriculum

Steps for Physics, B.S. - General Option: 120 units

Department Curriculum Committee Status: *Approved*

Participants

▲ **Physics and Astronomy Curriculum Committee**

Alexander Small *

Activity

Required for Approval: ***100% required***
Date Completed: ***2/1/2016 1:26 PM***
Changes: ***No***
Comments: ***No***
Agenda: ***Yes***

** Agenda Administrator*

Department Chair Status: *Approved*

Participants

Steven McCauley 3/2/2016 6:27 PM

Activity

Required for Approval: ***100% required***
Date Completed: ***3/2/2016 6:27 PM***
Changes: ***No***
Comments: ***No***

College Curriculum Committee Status: *Approved*

Participants

▲ **College of Science Curriculum Committee**

Nancy Buckley *

Activity

Required for Approval: ***100% required***
Date Completed: ***3/9/2016 9:38 AM***
Changes: ***No***
Comments: ***No***
Agenda: ***Yes***

** Agenda Administrator*

College Dean Status: *Approved*

Participants

Kristine Hartney 3/9/2016 1:21 PM

Activity

Required for Approval: ***100% required***
Date Completed: ***3/9/2016 1:21 PM***
Changes: ***No***
Comments: ***No***

Office of Academic Programs Status: *Restarted*

Participants	Activity
▲ **Office of Academic Programs** Ashley Ly * ▲ **Additional Participants**	**Required for Approval:** *100% required* **Date Completed:** *3/24/2016 4:01 PM* **Changes:** *Yes* **Comments:** *No* **Agenda:** *Yes* * *Agenda Administrator*

Office of Academic Programs — Status: *Working*

Participants	Activity
▲ **Office of Academic Programs** ○ Ashley Ly *	**Required for Approval:** *100% required* **Time Spent:** *12 days* **Changes:** *Yes* **Comments:** *No* **Agenda:** *Yes* * *Agenda Administrator*

University Faculty — Status: *Incomplete*

Participants	Step Details
	Required for Approval: *100% required* **Work:** *comment* **Agenda:** *Yes* * *Agenda Administrator*

Academic Senate - Academic Programs Committee — Status: *Incomplete*

Participants	Step Details
	Required for Approval: *100% required* **Work:** *comment* **Agenda:** *Yes* * *Agenda Administrator*

Academic Senate — Status: *Incomplete*

Participants	Step Details
	Required for Approval: *100% required* **Work:** *comment* **Agenda:** *Yes* * *Agenda Administrator*

Provost Status: *Incomplete*

Participants

Step Details
Required for Approval:
100% required
Work: ***comment***

President Status: *Incomplete*

Participants

Step Details
Required for Approval:
100% required
Work: ***comment***

Attachments for Physics, B.S. - General Option: 120 units

- **Assessment matrix-v02.xlsx** (uploaded by Claudia Pinter, 3/26/2016 10:45 pm)

Comments for Physics, B.S. - General Option: 120 units

Curriculog	3/28/2016 2:12 pm
Laura Menchen was added to the Office of Academic Programs Member role.	

Curriculog	3/28/2016 11:12 am
Melissa Stocking was added to the Office of Academic Programs Member role.	

Curriculog	3/26/2016 10:45 pm
Claudia Pinter has approved this proposal on Office of Academic Programs.	

Curriculog	3/24/2016 4:01 pm
System Administrator Inez Moran has restarted the Office of Academic Programs step as a result of participants being added to or removed from the step.	

Curriculog	3/22/2016 12:03 pm
Claudia Pinter has approved this proposal on Office of Academic Programs.	

Curriculog	3/9/2016 1:21 pm
Kristine Hartney has approved this proposal on College Dean.	

Curriculog	3/9/2016 9:38 am
Nancy Buckley has approved this proposal on College Curriculum Committee.	

Curriculog	3/2/2016 6:27 pm
Steven McCauley has approved this proposal on Department Chair.	

Curriculog	2/1/2016 1:26 pm
Alexander Small has approved this proposal on Department Curriculum Committee.	

Curriculog	1/17/2016 3:05 pm
Steven McCauley has approved this proposal on Department Curriculum Committee.	

Curriculog	12/15/2015 11:31 pm
Alexander Small has launched this proposal.	

Signatures for Physics, B.S. - General Option: 120 units

There are no signatures required on this proposal.

Crosslistings for Physics, B.S. - General Option: 120 units

- **Physics, B.S. - General Option: 120 units (parent proposal)**
- **This proposal does not have any active crosslisted proposals.**

Decision Summary for Physics, B.S. - General Option: 120 units

Office of Academic Programs	Status: *Working*

Step Summary
This step requires 100% approval from all participants to move forward.

Participants	Totals
▲ **Office of Academic Programs**	**Users Approved: *0***
○ **Ashley Ly ***	**Users Rejected: *0***