

BS IN PHYSICS (BIOPHYSICS)



SACRAMENTO STATE
Redefine the Possible

In Workflow

1. PHYS Committee Chair (mikkel.jensen@csus.edu)
2. PHYS Chair (ctaylor@csus.edu)
3. NSM College Committee Chair (mikkel.jensen@csus.edu)
4. NSM Dean (datwyler@csus.edu)
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Approval Path

1. Wed, 08 Sep 2021 00:40:17 GMT
Jerome Buerki (jerome.buerki): Rollback to Initiator
2. Fri, 01 Oct 2021 19:58:49 GMT
Jerome Buerki (jerome.buerki): Rollback to Initiator
3. Tue, 09 Nov 2021 22:56:13 GMT
Jerome Buerki (jerome.buerki): Approved for PHYS Committee Chair
4. Wed, 08 Dec 2021 17:32:34 GMT
Chris Taylor (ctaylor): Approved for PHYS Chair
5. Thu, 03 Feb 2022 01:40:01 GMT
Mikkel Jensen (mikkel.jensen): Rollback to Initiator
6. Fri, 09 Sep 2022 16:47:04 GMT
Mikkel Jensen (mikkel.jensen): Approved for PHYS Committee Chair
7. Fri, 09 Sep 2022 17:13:40 GMT
Chris Taylor (ctaylor): Approved for PHYS Chair
8. Wed, 21 Sep 2022 23:08:16 GMT
Mikkel Jensen (mikkel.jensen): Approved for NSM College Committee Chair
9. Wed, 21 Sep 2022 23:35:31 GMT
Shannon Datwyler (datwyler): Approved for NSM Dean

New Program Proposal

Date Submitted: Fri, 08 Jul 2022 18:23:02 GMT

Viewing: BS in Physics (Biophysics)

Last edit: Fri, 08 Jul 2022 18:23:01 GMT

Changes proposed by: Mikkel Jensen (218650862)

Academic Group: (College)

Natural Sciences & Mathematics

Academic Organization: (Department)

Physics and Astronomy

Catalog Year Effective:

2022-2023 Catalog

NOTE: This degree major program will be subject to program review evaluation within six years after implementation.

Individual(s) primarily responsible for drafting the proposed degree major program:

Name (First Last)	Email	Phone 999-999-9999
Eliza Morris	eliza.morris@csus.edu	916-278-7687
Mikkel Jensen	mikkel.jensen@csus.edu	916-278-7687

Type of Program Proposal:

Concentration

Is this a pilot program?

No

Pilot program as of:

2019

Is this a Fast Track program?

No

Title of the Program:

BS in Physics (Biophysics)

Designation: (degree terminology)

Bachelor of Science

Abstract of the proposal:

Biophysics is a rapidly growing field that brings together physical scientists from a variety of disciplines seeking to use quantitative methods to help better understand natural phenomenon. Scientists working in this field must have a strong background in both physics and biology, but currently no pathway exists at Sac State for students to easily enter this field. This new concentration will provide a pathway for studies in the biophysics field.

Briefly describe the program proposal (new or change) and provide a justification:

Currently there is no possible option for students to pursue studies or high level research in biophysics as biology is not a required course for the physics major. The proposed concentration offers a pathway for majors in the physics program into the field of biophysics, giving them a very strong background in physics and technical skills, complemented by relevant biology and chemistry courses, and culminating in a project experience with either a senior project with a faculty mentor (PHYS 191) or a project-oriented computational or experimental course (PHYS 163 or PHYS 116). The concentration is aimed at students who are considering further graduate studies in the area of biophysics rather than a traditional physics masters or PhD program, or who wish to enter the industry in the area of biophysics. We anticipate that new majors in this concentration will initially come from our department's majors. The concentration consists entirely of existing courses. We also don't anticipate that the concentration will require any additional sections to be offered of existing courses.

University Learning Goals**Undergraduate Learning Goals:**

Competence in the disciplines
 Knowledge of human cultures and the physical and natural world
 Integrative learning
 Personal and social responsibility
 Intellectual and practical skills

Program Learning Outcomes

Program Learning Outcomes

Learning Outcome

Students who complete this program will be able to:

1. Critically evaluate data and design experiments or simulations to test relevant hypotheses, including developing a testable hypothesis and a plan of action.
2. Read and evaluate primary literature in the discipline, and synthesize this information in writing.
3. Demonstrate ability to apply quantitative and analytical reasoning to physical problems relevant to biological physics, including problems of classical mechanics, thermodynamics and statistical mechanics, electricity and magnetism, and introductory modern physics.
4. Function successfully in the laboratory and use appropriate laboratory practices, including safe conduct and effective use of laboratory equipment for data acquisition.
5. Use electronic and computational tools effectively, for example in applying computer programming in problem-solving, or constructing and using electronic circuits and devices.
6. Effectively communicate scientific ideas and principles, using various formats appropriate for different target audiences, such as through oral or written communication.
7. Obtain awareness of ethical issues in the practice and conduct of science.
8. Effectively integrate and apply scientific ideas to study and analyze advanced problems involving experimental, theoretical, and/or computational approaches.
9. Use mathematical techniques and tools relevant to physics and biophysics.
10. Integrate knowledge from biology, chemistry, and physics to analyze biophysical problems.

Will this program be required as part of a teaching credential program, a single subject, or multiple subject waiver program (e.g., Liberal Studies, Biology) or other school personnel preparation program (e.g., School of Nursing)?

No

Please attach a Comprehensive Program Assessment Plan (required)

Biophysics-ProgramAssessmentPlan v3.docx

Please attach a Curriculum Map Matrix (required)

Biophysics-CurriculumMapMatrix v3.docx

Please attach a five-year budget projection (required)

Biophysics-BudgetStatement.docx

Please attach the Smart Planner roadmap:

PHYS_Biophysics BS v3.DOCX

Catalog Description:

Units required for Major: 74-82, includes units of study in chosen concentration (see below).

Total units required for BS: 120

Program Description

Physics is the most fundamental science and underlies our understanding of nearly all areas of science and technology. In a broad sense, physics is concerned with the study of energy, space, and matter, and with the interactions between matter and the laws that govern these interactions. More specifically, physicists study mechanics, heat, light, electric and magnetic fields, gravitation, relativity, atomic and nuclear physics, and condensed matter physics.

Biophysics utilizes mathematical and physical tools to study and describe biological systems. It is central to understanding the mechanisms of biological systems, ranging from the subcellular to the organism level. Trained in quantitative methods, biophysicists contribute towards a wide variety of problems, ranging from furthering our understanding of biological systems through basic research, to combating disease and developing new biologically inspired materials. This vibrant field brings together numerous traditional disciplines, including physics, biology, chemistry, engineering, material sciences, and mathematics.

Note: Students graduating with a Bachelor of Science Degree in Physics will not be subject to the University's Foreign Language Graduation Requirement. Students who change major may be subject to the University's Foreign Language Graduation Requirement.

Program Requirements: (If new courses are being created as part of a new program, it will be useful to propose courses first.)

Program Requirements

Code	Title	Units
REQUIRED LOWER DIVISION CORE COURSES (27 Units)		
MATH 30	Calculus I ¹	4
MATH 31	Calculus II	4

MATH 32	Calculus III	4
MATH 45	Differential Equations for Science and Engineering	3
PHYS 11A	General Physics: Mechanics ¹	4
PHYS 11B	General Physics: Heat, Light, Sound, Modern Physics	4
PHYS 11C	General Physics: Electricity and Magnetism	4

REQUIRED UPPER DIVISION CORE COURSES (17 Units)

PHYS 105	Mathematical Methods in Physics	3
PHYS 106	Introduction to Modern Physics	3
PHYS 110	Classical Mechanics	3
PHYS 124	Thermodynamics and Statistical Mechanics	3
PHYS 135	Electricity And Magnetism	3
PHYS 175	Advanced Physics Laboratory	2

PHYSICS COLLOQUIUM ATTENDANCE

Fulfill a minimum attendance requirement. ²

CONCENTRATION (30-38 Units)

Select from the following concentrations: 30 - 38

General Physics	
Applied Physics	
Biophysics	

Total Units 74-82

¹ Course also satisfies General Education (GE)/Graduation Requirement.

² Majors must fulfill a minimum attendance requirement at Department Colloquia. Students should consult with the Department for details.

Notes:

- Students graduating with a BS in Physics will not be subject to the University's Foreign Language Graduation Requirement. Students who change major may be subject to the University's Foreign Language Graduation Requirement.

Concentration in Biophysics (34-38 units)

Code	Title	Units
REQUIRED COURSES (33-34 Units)		
BIO 1	Biodiversity, Evolution and Ecology ¹	5
BIO 2	Cells, Molecules and Genes	5
CHEM 1A	General Chemistry I	5
CHEM 1B	General Chemistry II	5
PHYS 115	Electronics and Instrumentation	4
PHYS 162	Scientific Computing: Basic Methods	3
PHYS 172	Biological Physics	3
PHYS 199	Special Problems ²	1
Select one of the following:		2 - 3
PHYS 116	Advanced Electronics and Instrumentation	
PHYS 163	Scientific Computing: Modeling, Simulation, and Visualization	
PHYS 191	Senior Project	

ELECTIVE COURSES (1-4 Units)

Select a minimum of 1 unit of upper-division coursework in the College of Natural Sciences and Mathematics chosen in consultation with an advisor. ³ 1 - 4

Total Units 34-38

¹ Course also satisfies General Education (GE)/Graduation Requirement.

² Majors must complete 1 unit of PHYS 199 under the supervision of a faculty member. Students are encouraged to take PHYS 199 their junior year in preparation for further project work in the form of a summer research experience or a senior project (PHYS 191) if they choose this option for their senior year. Additional units of PHYS 199 may be taken subsequently to count towards elective units.

³ See list below for a list of Department approved electives. Other electives may be approved; please consult your Major Advisor.

Elective List

Code	Title	Units
BIO 102	The Natural History of Plants	3
BIO 103	Plants and Civilization	3

BIO 104	Physiology of Human Reproduction	3
BIO 106	Genetics: From Mendel to Molecules	3
BIO 112	Plant Taxonomy	4
BIO 113	Evolution and Speciation in Flowering Plants	3
BIO 118	Natural Resource Conservation	3
BIO 120	Biology of Aging	3
BIO 122	Advanced Human Anatomy	4
BIO 123	Neuroanatomy	3
BIO 126	Comparative Vertebrate Morphology	3
BIO 127	Developmental Biology	4
BIO 128	Plant Anatomy and Physiology	4
BIO 130	Histology	3
BIO 131	Systemic Physiology	4
BIO 140	Medical Microbiology and Emerging Infectious Diseases	3
BIO 152	Human Parasitology	3
BIO 157	General Entomology	4
BIO 160	General Ecology	3
BIO 162	Ichthyology: The Study of Fishes	3
BIO 164	Amphibians and Reptiles: An Introduction to Herpetology	3
BIO 165	Vertebrate Zoology	3
BIO 166	Ornithology	3
BIO 168	Mammalogy	4
BIO 169	Animal Behavior	3
BIO 184	General Genetics	4
BIO 185	Topics in Biology	3
BIO 188	Evolution	3
CHEM 124	Organic Chemistry Lecture II	3
CHEM 140A	Physical Chemistry Lecture I	3
CHEM 142	Introduction to Physical Chemistry	4
CHEM 161	General Biochemistry	3
PHYS 116	Advanced Electronics and Instrumentation ⁵	3
PHYS 130	Acoustics	3
PHYS 136	Electrodynamics of Waves, Radiation, and Materials	3
PHYS 142	Applied Solid State Physics	3
PHYS 145	Optics	3
PHYS 150	Quantum Mechanics	3
PHYS 156	Classical and Statistical Mechanics	3
PHYS 163	Scientific Computing: Modeling, Simulation, and Visualization ⁵	3
PHYS 175	Advanced Physics Laboratory	2
PHYS 191	Senior Project ⁴	2
PHYS 199	Special Problems ⁴	1 - 3

⁴ If not used to satisfy other requirement of the degree. Example: PHYS 116, PHYS 163, or PHYS 191 are required for the Bachelor of Science. If more than one is taken, the others will count as electives. Additional units of PHYS 199 beyond the required 1 unit will also be counted as electives.

General Education Requirements¹

Code	Title	Units
AREA A: BASIC SUBJECTS (6 Units)		
A1	Oral Communication	3
A2	Written Communication	3
A3	Critical Thinking ²	0
AREA B: PHYSICAL UNIVERSE AND ITS LIFE FORMS (3 Units)		
B1	Physical Science ²	0
B2	Life Forms ²	0
B3	Lab (Lab experience to be taken with one of the following: B1, B2 or B5) ²	0
B4	Math Concepts ²	0
B5	Additional Course - Take upper-division course to complete Area & upper division requirements.	3

AREA C: ARTS AND HUMANITIES (12 Units)

C1 - Arts	3
C2 - Humanities	3
C1/C2 - Area C Course	3
C1/C2 - Area C Course - Take upper-division course to complete Area & upper division requirements.	3

AREA D: THE INDIVIDUAL AND SOCIETY (9 Units)

Area D Course	3
Area D Course	3
Area D Course - Take upper-division course to complete Area & upper division requirements.	3

AREA E: UNDERSTANDING PERSONAL DEVELOPMENT (3 Units)

Area E Course	3
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AREA F: ETHNIC STUDIES (3 Units)

Area F Course	3
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Total Units	36
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¹ To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (<https://catalog.csus.edu/colleges/academic-affairs/general-education/>).

Note: There is no way to list all possible overlaps so please consult with a professional advisor. The Academic Advising Center can be visited online (<http://www.csus.edu/acad/>), by phone (916) 278-1000, or email (advising@csus.edu).

² Required in Major; also satisfies GE.

Graduation Requirements ¹

Code	Title	Units
GRADUATION REQUIREMENTS (REQUIRED BY CSU) (9 Units)		
	American Institutions: U.S. History	3
	American Institutions: U.S. Constitution & CA Government	3
	Writing Intensive (WI)	3
GRADUATION REQUIREMENTS (REQUIRED BY SACRAMENTO STATE) (6 Units)		
	English Composition II	3
	Race and Ethnicity in American Society (RE)	3
	Foreign Language Proficiency Requirement ²	0

¹ To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (<https://catalog.csus.edu/colleges/academic-affairs/general-education/>).

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² If not satisfied before entering Sacramento State, it may be satisfied in General Education Area C2 (Humanities). "C- or better required." The alternative methods for satisfying the Foreign Language Proficiency Requirement are described here: <https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html>

Note: Students with a declared major of BS in Physics (Biophysics) are exempt from the Foreign Language Graduation Requirement.

Attach the results of a formal survey in the geographical area to be served indicating demand for individuals who have earned the proposed degree and evidence of serious student interest in majoring in the proposed program:

BS Physics (Biophysics) surveys.docx

For graduate programs, the number of declared undergraduate major and the degree production over the preceding years of the corresponding baccalaureate program:

n/a

Professional uses of the proposed degree major program:

n/a

The expected number of majors in:

1st Year Enrollment:

2

3rd Year Enrollment:

2

5th Year Enrollment:

2

1st Year Graduates:

0

3rd Year Graduates:

1

5th Year Graduates:

2

Reviewer Comments:

Jerome Buerki (jerome.buerki) (Wed, 08 Sep 2021 00:40:17 GMT): Rollback: Need to align the smart planner road map with the matrix

Jerome Buerki (jerome.buerki) (Fri, 01 Oct 2021 19:58:49 GMT): Rollback: Need to make learning goals more specific and update the program assessment plan.

Mikkel Jensen (mikkel.jensen) (Thu, 03 Feb 2022 01:40:01 GMT): Rollback: Revise curriculum map to explicitly list all required courses for SLOs.

Key: 419