

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)
5. Academic Services (catalog@csus.edu)
6. Senate Curriculum Subcommittee Chair (curriculum@csus.edu)
7. Faculty Senate Executive Committee Chair (kathy.honeychurch@csus.edu)
8. Faculty Senate Chair (kathy.honeychurch@csus.edu)
9. Dean of Undergraduate (gardner@csus.edu)
10. Dean of Graduate (cnewsome@skymail.csus.edu)
11. President (210748526@csus.edu)
12. Provost (amy.wallace@csus.edu; minekh@csus.edu)
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14. Board of Trustees (torsetj@csus.edu)
15. WASC (amy.wallace@csus.edu)
16. Catalog Editor (catalog@csus.edu)
17. Registrar's Office (k.mcfarland@csus.edu)

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
10. Tue, 11 Oct 2022 22:16:40 GMT
Katie Hawke (katiedickson): Approved for Academic Services
11. Tue, 16 May 2023 22:38:33 GMT
Rachel Miller (rachel.miller): Approved for Senate Curriculum Subcommittee Chair
12. Wed, 13 Sep 2023 23:00:23 GMT
Kathy Honeychurch (kathy.honeychurch): Rollback to Senate Curriculum Subcommittee Chair for Faculty Senate Executive Committee Chair
13. Tue, 19 Sep 2023 16:49:23 GMT
Rachel Miller (rachel.miller): Rollback to Initiator
14. Wed, 27 Sep 2023 18:39:29 GMT

Mikkel Jensen (mikkel.jensen): Approved for PHYS Committee Chair

15. Wed, 27 Sep 2023 18:47:19 GMT
Chris Taylor (ctaylor): Approved for PHYS Chair
16. Thu, 05 Oct 2023 03:26:20 GMT
Mikkel Jensen (mikkel.jensen): Approved for NSM College Committee Chair
17. Tue, 17 Oct 2023 16:47:21 GMT
Shannon Datwyler (datwyler): Approved for NSM Dean
18. Thu, 02 Nov 2023 23:05:59 GMT
Katie Hawke (katiedickson): Approved for Academic Services

New Program Proposal

Date Submitted: Tue, 19 Sep 2023 20:25:26 GMT

Viewing: BS in Physics (Biophysics)

Last edit: Thu, 05 Oct 2023 03:22:55 GMT

Changes proposed by: Mikkel Jensen (218650862)

Academic Group: (College)

Natural Sciences & Mathematics

Academic Organization: (Department)

Physics and Astronomy

Catalog Year Effective:

2024-2025 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 Herholdt Jensen	mikkel.jensen@csus.edu	916-278-7687

Type of Program Proposal:

Concentration

Is this a pilot program?

No

Pilot program as of:

2019

Delivery Format:

Fully Face to Face

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
 Intellectual and practical skills
 Personal and social responsibility
 Integrative learning

Program Learning Outcomes

Program Learning Outcomes

Learning Outcome

Apply scientific reasoning to solve advanced physics problems and design, carry out and analyze hands-on and numerical experiments.

Communicate physics concepts and particularly their own scientific results in written documents (e.g., senior project reports and research papers).

Explain physics concepts and particularly their own scientific results through a variety of media, including oral (e.g., presentations, seminars) and visual communication (e.g., graphs, figures, posters).

Apply scientific reasoning to solve advanced physics problems and/or to design, carry out, and analyze experiments.

Locate, retrieve, read, draw conclusions, and critically evaluate physics and other related scientific research literature.

Use physics concepts and mathematics to develop models that describe theoretical and/or experimental results or predict physics phenomena.

Act with professional integrity and employ scientific ethics in their professional interactions.

Integrate knowledge of physics concepts, mathematics, and related disciplines when performing their own scientific work.

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)

BS Physics AssessmentPlan.docx

Please attach a Curriculum Map Matrix (required)

BS Physics CurriculumMapMatrix.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.

The BS degrees are recommended for students seeking a career in the technology sector or planning to pursue a graduate degree.

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 ¹	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.

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 ³	1
Select one of the following (2 units minimum):		2 - 3
PHYS 116	Advanced Electronics and Instrumentation	
PHYS 163	Scientific Computing: Modeling, Simulation, and Visualization	
PHYS 191	Senior Project ⁴	
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. ⁵		1 - 4
Total Units		34-38

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

³ 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.

⁴ Students choosing Senior Project can take 1 unit of PHYS 191 in two consecutive semesters, or 2 units in one semester.

⁵ See list below for a list of Department approved electives. Other 100-level CHEM, BIO, or PHYS courses may be approved as electives after discussion with major advisor.

Elective List

Code	Title	Units
BIO 104	Physiology of Human Reproduction	3
BIO 120	Biology of Aging	3
BIO 126	Comparative Vertebrate Morphology	3
BIO 128	Plant Anatomy and Physiology	4
BIO 131	Systemic Physiology	4
BIO 152	Human Parasitology	3
BIO 157	General Entomology	4
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
PHYS 116	Advanced Electronics and Instrumentation ⁶	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 ⁶	3
PHYS 191	Senior Project ⁶	2
PHYS 195	Teaching Internship	1 - 2
PHYS 199	Special Problems ⁶	1 - 3
NSM 195A	STEM Pedagogical Practices	1
NSM 195B	Field Experience in Secondary STEM Classrooms	1

⁶ If not used to satisfy other requirement of the degree. Example: PHYS 116, PHYS 163, or PHYS 191 are required for the BS in Physics (Biophysics) concentration. If two of the three are taken, one will count as an elective. Additional units of PHYS 199 beyond the required 1 unit will also be counted as electives.

General Education Requirements ⁷

Code	Title	Units
AREA A: BASIC SUBJECTS (9 Units)		
A1	Oral Communication	3
A2	Written Communication	3
A3	Critical Thinking	3
AREA B: PHYSICAL UNIVERSE AND ITS LIFE FORMS (3 Units)		
B1	Physical Science ⁸	0
B2	Life Forms ⁸	0
B3	Lab (Lab experience to be taken with one of the following: B1, B2 or B5) ⁸	0
B4	Math Concepts ⁸	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
AREA F: ETHNIC STUDIES (3 Units)	
Area F Course	3
Total Units	39

⁷ 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).

⁸ Required in Major; also satisfies GE.

Graduation Requirements ⁷

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 ⁹	0

⁷ 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).

⁹ 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 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

Please attach any additional files not requested above:

Biophysics_60-unit-waiver.pdf
 Chemistry correspondence.pdf
 Biological Science correspondence.pdf

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.

Kathy Honeychurch (kathy.honeychurch) (Wed, 13 Sep 2023 23:00:23 GMT): Rollback: Per the Executive Committee on 9/12 the proposal is being rolled back to address: 1. There needs to be documented consultation with the departments of Biological Sciences and Chemistry 2. The learning outcomes of all Physics BS concentrations must be exactly the same (currently they are not) 3. The attachments provided must apply to the degree level (i.e., the BS level instead of concentration level), and therefore must apply to all Physics BS concentrations. 4. In the Elective List, PHYS 116 has been given a footnote superscript of "5". This should be "4". 5. In the Required Courses section, the last requirement is for students to choose PHYS 116, 163, or 191. The unit count listed is "2-3". However, PHYS 191 can be taken for 1 unit, so the units listed for this requirement should be "1-3". If the intention is that students choosing to take PHYS 191 must take it at least once for two units or twice for one unit both times, then you would keep the unit requirement listed as "2-3" but would need to somehow specify the need to take two units of PHYS 191 (if selected). You could have a footnote that explains this or you could do what you did for the Applied Physics concentration (probably preferred) where you simply have the heading for the requirement state: "Select one of the following (2 units minimum)."

Rachel Miller (rachel.miller) (Tue, 19 Sep 2023 16:49:23 GMT): Rollback: Update SLOs, upload updated assessment plan and curriculum map (as per email with Mikkel Jensen on 9/18/23)

Mikkel Jensen (mikkel.jensen) (Thu, 05 Oct 2023 03:25:46 GMT): Removed some courses with prerequisites not included in the concentration from the list of pre-approved elective options after consultation with the Departments of Chemistry and Biological Sciences.

Key: 419