

BS IN PHYSICS (APPLIED PHYSICS)



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)
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Approval Path

1. Wed, 27 Sep 2023 18:39:25 GMT
Mikkel Jensen (mikkel.jensen): Approved for PHYS Committee Chair
2. Wed, 27 Sep 2023 18:46:01 GMT
Chris Taylor (ctaylor): Approved for PHYS Chair
3. Thu, 05 Oct 2023 03:26:25 GMT
Mikkel Jensen (mikkel.jensen): Approved for NSM College Committee Chair
4. Tue, 17 Oct 2023 16:47:17 GMT
Shannon Datwyler (datwyler): Approved for NSM Dean
5. Thu, 02 Nov 2023 22:55:31 GMT
Katie Hawke (katiedickson): Approved for Academic Services

History

1. May 3, 2018 by clmig-jwehrheim
2. Aug 9, 2018 by Kaitlyn Ehrmantrout (k.ehrmantrout)
3. Oct 2, 2018 by Kaitlyn Ehrmantrout (k.ehrmantrout)
4. Apr 28, 2020 by 220267334
5. Apr 20, 2021 by 220267334

Date Submitted: Sat, 16 Sep 2023 23:27:36 GMT

Viewing: BS in Physics (Applied Physics)

Last approved: Tue, 20 Apr 2021 21:16:00 GMT

Last edit: Fri, 22 Sep 2023 21:59:51 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

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

| Name (First Last) | Email | Phone 999-999-9999 |
|------------------------|------------------------|--------------------|
| Mikkel Herholdt Jensen | mikkel.jensen@csus.edu | 9162787687 |

Type of Program Proposal:

Major

Program Change Type:

Substantive

Delivery Format:

Fully Face to Face

Title of the Program:

BS in Physics (Applied Physics)

Designation: (degree terminology)

Bachelor of Science

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

The purpose of this program change proposal is:

- A non-substantive reformatting of the program in the Catalog to list the "core" and "concentration" courses under the BS in Physics program. The BS in Physics is being renamed to "BS in Physics (General Physics) to distinguish it from the other "BS in Physics" in the Department. Justification: This format is required by administration.
- Expanding the elective list to include PHYS 172, a recently created physics course, as an elective option. This course is introduced as a required course in the new BS in Physics (Biophysics) concentration, but is also an eligible elective for our other concentrations, and will broaden the elective options in the program. The form also adds PHYS 195, NSM 195A, and NSM 195B as official electives. These are already approved by the Department as electives for the program, and so this change brings the catalog in line with the practices already in place.
- Updating the math requirement from PHYS 105 or MATH 105A to only list PHYS 105. Justification: The Department's subsequent physics courses requires PHYS 105 as a prerequisite, and the listing of either PHYS 105 or MATH 105A is contradictory to this requirement. The listing has led some students to take MATH 105A assuming it would satisfy their prerequisite for future courses, negatively impacting their progress to degree, so the Department is cleaning up this requirement to avoid this issue.

There are no other changes to the program as part of this program change proposal. The changes outlined above do not affect any of the fiscal needs or space needs of the Department or College.

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)

BudgetStatement.docx

Do these changes impact the Smart Planner roadmap?

Yes

Please attach the Smart Planner roadmap:

PHYS_Applied Physics BS.DOCX

Briefly describe the change:

Removal of MATH 105A, reduction of GE area D from 12 to 9 units, and inclusion of GE area F.

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.

As defined by policy <http://www.csus.edu/umannual/acadaff/fsm00010.htm>, a change in units constitutes a substantive change to the program. If your changes constitute a substantive change, please refer back to the "Program Change Type" field above to ensure that "Substantive" is selected.

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 Applied Physics (31-32)

| Code | Title | Units |
|--|---|-------|
| CHEM 1E | General Chemistry for Engineering | 4 |
| ENGR 45 | Engineering Materials | 3 |
| CSC 25 | Introduction to C Programming | 3 |
| PHYS 115 | Electronics and Instrumentation | 4 |
| PHYS 150 | Quantum Mechanics | 3 |
| PHYS 162 | Scientific Computing: Basic Methods | 3 |
| 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 ³ | |

Elective Courses (9 Units)

Select 9 units of upper-division coursework in Physics or Engineering courses chosen in consultation with an advisor. ⁴ 9

Total Units **31-32**

³ Students choosing Senior Project can take 1 unit of PHYS 191 in two consecutive semesters, or 2 units in one semester.

⁴ See list below for a list of Department approved electives.

Elective List

| Code | Title | Units |
|-----------|--|-------|
| 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 151 | Advanced Modern Physics | 3 |
| PHYS 156 | Classical and Statistical Mechanics | 3 |
| PHYS 163 | Scientific Computing: Modeling, Simulation, and Visualization ⁵ | 3 |
| PHYS 172 | Biological Physics | 3 |
| PHYS 195 | Teaching Internship | 1 - 2 |
| PHYS 199 | Special Problems | 1 - 3 |
| EEE 130 | Electromechanical Conversion | 3 |
| EEE 135 | Renewable Electrical Energy Sources and Grid Integration | 3 |
| ENGR 112 | Mechanics Of Materials | 3 |
| ENGR 132 | Fluid Mechanics | 3 |
| ENGR 181 | Electronic Materials | 3 |
| ME 121 | Solar Thermal and Energy Storage Systems | 2 |
| ME 122 | Geothermal and Bioenergy Systems | 2 |
| ME 123 | Wind, Hydro and Ocean Energy | 3 |
| ME 154 | Alternative Energy Systems | 3 |
| MATH 104 | Vector Analysis | 3 |
| MATH 105B | Advanced Mathematics for Science and Engineering II | 4 |

| | | |
|----------|---|---|
| NSM 195A | STEM Pedagogical Practices | 1 |
| NSM 195B | Field Experience in Secondary STEM Classrooms | 1 |

⁵ 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 (Applied Physics) concentration. If two of the three are taken, one will count as an elective).

General Education Requirements ⁶

| 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 (6 Units) | | |
| B1 | Physical Science ⁷ | 0 |
| B2 | Life Forms | 3 |
| B3 | Lab (Note: Lab experience to be taken with one of the following: B1, B2 or B5) ⁷ | 0 |
| B4 | Math Concepts ⁷ | 0 |
| B5 | Additional Course (Any B to reach 12 units) - 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 | | 42 |

⁶ 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 (<http://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).

⁷ Required in Major; also satisfies GE.

Graduation Requirements ⁶

| 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 ⁸ | | 0 |

⁶ 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 (<http://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 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 (<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.

Fiscal Impact to Change an Existing Program

Indicate programmatic or fiscal impact which this change will have on other academic units' programs, and describe the consultation that has occurred with affected units:

Due to the removal of MATH 105A from the program, we have consulted with the Department of Mathematics and Statistics (see attached). In practice, due to the prerequisite requirements of subsequent physics courses, almost all students would choose to take PHYS 105 for their degree, except for students also majoring or minoring in mathematics, and so the practical impact on the enrollment in both these courses is expected to be negligible.

Attach a copy of correspondence with these units:

Memo Style.pdf

Provide a fiscal analysis of the proposed changes:

n/a

How will the above changes be accommodated within the department/College existing fiscal resources?

n/a

Will the proposed changes require additional resources?

No

What additional space, equipment, operating expenses, library, computer, or media resources, clerical/technical support, or other resources will be needed?

n/a

Estimate the cost and indicate how these resource needs will be accommodated:

n/a

Key: 220