BACHELOR OF SCIENCE (BS) DEGREE WITH A MAJOR IN PHYSICS AND A MAJOR CONCENTRATION IN COMPUTATIONAL PHYSICS

Program Learning Outcomes for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

Upon completing the BS degree with a major in Physics and a major concentration in Computational Physics, students will be able to:

1. Demonstrate an understanding of fundamental concepts in Mechanics.
2. Demonstrate an understanding of fundamental concepts in Electromagnetism.
3. Demonstrate an understanding of fundamental concepts in Quantum Mechanics.
4. Be knowledgeable of the use of numerical analysis to apply the laws of physics to real-world problems.
5. Demonstrate proficiency in research techniques and methodology under guidance of a faculty member.
6. Communicate scientific results both in writing and oral presentations.

Requirements for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

For general university requirements, see Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements). Students pursuing the BS degree with a major in Physics and a major concentration in Computational Physics must complete:

- A minimum of 72 credit hours to satisfy major requirements.
- A minimum of 132 credit hours to satisfy degree requirements.
- A minimum of 60 credit hours outside of major requirements.
- A minimum of 38 credit hours taken at the 300-level or above.
- Core courses common to all major concentrations.
- The requirements for the major concentration in Computational Physics. When students declare the major (ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/#text) in Physics, students must additionally identify and declare one of the major concentrations, either in:
  - Applied Physics (ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/applied-physics-bs/#requirementstext), or
  - Biological Physics (ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/biological-physics-bs/#requirementstext), or
  - General Physics (ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/general-physics-bs/#requirementstext)

Because of the common core requirements, it is possible for students to change their major concentration at any time, even after initially declaring the major. To do so, please contact the Office of the Registrar (registrar@rice.edu).

Students may obtain credit for some courses by advanced placement, and the department's undergraduate committee can modify requirements to meet the needs of students with special backgrounds.

The courses listed below satisfy the requirements for this major. In certain instances, courses not on this official list may be substituted upon approval of the department's undergraduate committee. (Course substitutions must be formally applied and entered into Degree Works by the major's Official Certifier (https://registrar.rice.edu/facstaff/dregeworks/officialcertifier).) Students and their academic advisors should identify and clearly document the courses to be taken.

Summary

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the Major in Physics with a Major Concentration in Computational Physics</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Total Credit Hours Required for the BS Degree with a Major in Physics and Major Concentration in Computational Physics</td>
<td>132</td>
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</tbody>
</table>

Degree Requirements

Core Requirements

Select 1 from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 101</td>
<td>MECHANICS (WITH LAB) &amp; PHYS 103 and MECHANICS DISCUSSION</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 111</td>
<td>HONORS MECHANICS (WITH LAB)</td>
<td></td>
</tr>
</tbody>
</table>

Select 1 from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 102</td>
<td>ELECTRICITY &amp; MAGNETISM (WITH LAB) &amp; PHYS 104 and ELECTRICITY AND MAGNETISM DISCUSSION</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 112</td>
<td>HONORS ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
<td></td>
</tr>
</tbody>
</table>

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<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>PHYS 201</td>
<td>WAVES, LIGHT, AND HEAT</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 202</td>
<td>MODERN PHYSICS</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 231</td>
<td>ELEMENTARY PHYSICS LAB</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 301</td>
<td>INTERMEDIATE MECHANICS</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 311</td>
<td>INTRODUCTION TO QUANTUM PHYSICS I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 491</td>
<td>UNDERGRADUATE RESEARCH &amp; PHYS 493 and UNDERGRADUATE RESEARCH SEMINAR</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 492</td>
<td>UNDERGRADUATE RESEARCH &amp; PHYS 494 and UNDERGRADUATE RESEARCH SEMINAR</td>
<td>3</td>
</tr>
<tr>
<td>MATH 101</td>
<td>SINGLE VARIABLE CALCULUS I</td>
<td>3</td>
</tr>
</tbody>
</table>
Bachelor of Science (BS) Degree with a Major in Physics and a Major Concentration in Computational Physics

or MATH 105  AP/OTH CREDIT IN CALCULUS I  3
MATH 102  SINGLE VARIABLE CALCULUS II  3
or MATH 106  AP/OTH CREDIT CALCULUS II
MATH 211  ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA  3
or MATH 220  HONORS ORDINARY DIFFERENTIAL EQUATIONS
or MATH 221  HONORS CALCULUS III
MATH 212  MULTIVARIABLE CALCULUS  3
or MATH 222  HONORS CALCULUS IV

Major Concentration in Computational Physics  3
PHYS 302  INTERMEDIATE ELECTRODYNAMICS  4
PHYS 312  INTRODUCTION TO QUANTUM PHYSICS II  3
or PHYS 425  STATISTICAL & THERMAL PHYSICS
PHYS 416  COMPUTATIONAL PHYSICS  3
CAAM 210  INTRODUCTION TO ENGINEERING COMPUTATION  3
CAAM 335  MATRIX ANALYSIS  3
CAAM 336  DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING  3
CAAM 453  NUMERICAL ANALYSIS I  3
COMP 130  ELEMENTS OF ALGORITHMS AND COMPUTATION  4
or COMP 140  COMPUTATIONAL THINKING
Select 2 from the following:  6
CAAM 435 / MATH 435  DYNAMICAL SYSTEMS
CAAM 454  NUMERICAL ANALYSIS II
CAAM 520  COMPUTATIONAL SCIENCE II
CAAM 536 / CEVE 555  DIFFERENTIAL EQUATIONS
CAAM 519  COMPUTATIONAL SCIENCE I
PHYS 580  INTRODUCTION TO PLASMA PHYSICS

Total Credit Hours Required for the Major in Physics and a Major Concentration in Computational Physics  72
University Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements)  60

Total Credit Hours  132

Footnotes and Additional Information
1 PHYS 491 and PHYS 493 must be taken concurrently.
2 PHYS 492 and PHYS 494 must be taken concurrently.
3 Because of common core requirements, it is possible to change major concentrations even after declaring the major. See the Undergraduate tab of the Physics and Astronomy department listing for the requirements for each major concentration for the BS degree in Physics.

Policies for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

Transfer Credit
For Rice University’s policy regarding transfer credit, see Transfer Credit (ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit). Some departments and programs have additional restrictions on transfer credit. The Office of Academic Advising maintains the university’s official list of transfer credit advisors on their website: https://oaa.rice.edu. Students are encouraged to meet with their academic program’s transfer credit advisor when considering transfer credit possibilities.

Departmental Transfer Credit Guidelines
Students pursuing the major in Physics should be aware of the following department transfer credit guidelines:
• Requests for transfer credit will be considered by the program director (and/or the program’s official transfer credit advisor) on an individual case-by-case basis.

Additional Information
For additional information, please see the Physics and Astronomy website: http://physics.rice.edu/.

Opportunities for the BS Degree with a Major in Physics and a Major Concentration in Computational Physics

Academic Honors
The university recognizes academic excellence achieved over an undergraduate’s academic history at Rice. For information on university honors, please see Latin Honors (ga.rice.edu/undergraduate-students/honors-distinctions/university) (summa cum laude, magna cum laude, and cum laude) and Distinction in Research and Creative Work (ga.rice.edu/undergraduate-students/honors-distinctions/university). Some departments have department-specific Honors awards or designations.

Research in the Department of Physics and Astronomy
The Physics and Astronomy Department encourages undergraduate participation in research, both within the department and through extramural programs. For current opportunities, please visit the Department’s website and click on the Undergraduate Study link, at: http://www.physics.rice.edu/.

Additional Information
For additional information, please see the Physics and Astronomy website: http://physics.rice.edu/.