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 (https://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 (https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/#text) in Physics, students must additionally identify and declare one of four major concentrations, either in:
  - Applied Physics (https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/applied-physics-bs/#requirementstext), or
  - Biological Physics (https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/biological-physics-bs/#requirementstext), or
  - Computational Physics (p. 1), or

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 (%20registrar@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/degreeworks/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 and 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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Degree Requirements

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>MATH 101</td>
<td>SINGLE VARIABLE CALCULUS I</td>
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<tr>
<td>or MATH 105</td>
<td>AP/OTH CREDIT IN CALCULUS I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 102</td>
<td>SINGLE VARIABLE CALCULUS II</td>
<td>3</td>
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<tr>
<td>or MATH 106</td>
<td>AP/OTH CREDIT IN CALCULUS II</td>
<td>3</td>
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<tr>
<td>MATH 211</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 220</td>
<td>HONORS ORDINARY DIFFERENTIAL EQUATIONS</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 221</td>
<td>HONORS CALCULUS III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 212</td>
<td>MULTIVARIABLE CALCULUS</td>
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<tr>
<td>or MATH 222</td>
<td>HONORS CALCULUS IV</td>
<td>3</td>
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Select 1 from the following:

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>PHYS 101 &amp; PHYS 103</td>
<td>MECHANICS (WITH LAB) &amp; MECHANICS DISCUSSION</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 111</td>
<td>HONORS MECHANICS (WITH LAB)</td>
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</table>

Select 1 from the following:

<table>
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<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>PHYS 102 &amp; PHYS 104</td>
<td>ELECTRICITY &amp; MAGNETISM (WITH LAB) &amp; ELECTRICITY AND MAGNETISM DISCUSSION</td>
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<tr>
<td>PHYS 112</td>
<td>HONORS ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
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<tr>
<td>PHYS 201</td>
<td>WAVES, LIGHT, AND HEAT</td>
<td>3</td>
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<td>PHYS 202</td>
<td>MODERN PHYSICS</td>
<td>3</td>
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<tr>
<td>PHYS 231</td>
<td>ELEMENTARY PHYSICS LAB</td>
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<tr>
<td>PHYS 301</td>
<td>INTERMEDIATE MECHANICS</td>
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</tbody>
</table>
Bachelor of Science (BS) Degree with a Major in Physics and a Major Concentration in Computational Physics

PHYS 311 | INTRODUCTION TO QUANTUM PHYSICS I | 3
PHYS 491 & PHYS 493 | UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR ¹ | 3
PHYS 492 & PHYS 494 | UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR ² | 3

Major Concentration in Computational Physics ³

PHYS 302 | INTERMEDIATE ELECTRODYNAMICS | 4
PHYS 312 & PHYS 425 | INTRODUCTION TO QUANTUM PHYSICS II and STATISTICAL & THERMAL PHYSICS | 3
PHYS 416 | COMPUTATIONAL PHYSICS | 3
CAAM 210 | INTRODUCTION TO ENGINEERING COMPUTATION | 3

CAAM 334 | MATRIX ANALYSIS FOR DATA SCIENCE or 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 or COMP 140 | COMPUTATIONAL THINKING | 4

Select 2 courses from the following: 6
CAAM 435 / MATH 435 | DYNAMICAL SYSTEMS
CAAM 454 | NUMERICAL ANALYSIS II
CAAM 520 | COMPUTATIONAL SCIENCE II
CAAM 536 / CEVE 555 | NUMERICAL METHODS FOR PARTIAL 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 (https://ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements/) | 60

Total Credit Hours | 132

Footnotes and Additional Information

* Includes coursework completed as distribution credit, FWIS, LPAP, upper-level, residency (hours taken at Rice), 60 hours outside of the major (if applicable), and any additional academic program requirements. The “hours outside of the major” requirement may include all of the above university requirements.

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 (https://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: https://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 (https://ga.rice.edu/undergraduate-students/honors-distinctions/university/) (summa cum laude, magna cum laude, and cum laude) and Distinction in Research and Creative Work (https://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: https://physics.rice.edu/.

Additional Information

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