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

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

Upon completing the BS Degree with a major in 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.

Additionally, upon completing the BS degree with a major in Physics and a major concentration in Applied Physics, students will be able to:

1. Be knowledgeable in the applications of physics concepts to real world devices and applications.
2. Demonstrate proficiency in research techniques and methodology under guidance of a faculty member.
3. Communicate scientific results both in writing and oral presentations.

Requirements for the BS Degree with a Major in Physics and a Major Concentration in Applied 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 Applied Physics must complete:

- A minimum of 68 credit hours to satisfy major requirements.
- A minimum of 120 credit hours to satisfy degree requirements.
- A minimum of 37 credit hours taken at the 300-level or above.
- Core courses common to all major concentrations.
- The requirements for the major concentration in Applied 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 (p. 1), or
  - Biological Physics (https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/biological-physics-bs/#requirementstext), or
  - Computational Physics (https://ga.rice.edu/programs-study/departments-programs/natural-sciences/physics-astronomy/computational-physics-bs/#requirementstext), 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 (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 Physics and Astronomy 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/degeworks/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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<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the Major in Physics and a Major Concentration in Applied Physics</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Total Credit Hours Required for the BS Degree with a Major in Physics and a Major Concentration in Applied Physics</td>
<td>120</td>
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Degree Requirements

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<tr>
<th>Code</th>
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<tr>
<td></td>
<td>Core Requirements</td>
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<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>
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<td>MATH 102</td>
<td>SINGLE VARIABLE CALCULUS II</td>
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<tr>
<td>or MATH 106</td>
<td>AP/OTH CREDIT IN CALCULUS II</td>
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<tr>
<td>MATH 211</td>
<td>ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA</td>
<td>3</td>
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<tr>
<td>or MATH 220</td>
<td>HONORS ORDINARY DIFFERENTIAL EQUATIONS</td>
<td></td>
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<tr>
<td>or MATH 221</td>
<td>HONORS CALCULUS III</td>
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<tr>
<td>MATH 212</td>
<td>MULTIVARIABLE CALCULUS</td>
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<tr>
<td>or MATH 222</td>
<td>HONORS CALCULUS IV</td>
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<tr>
<td>or MATH 223</td>
<td>HONORS MULTIVARIABLE CALCULUS</td>
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<tbody>
<tr>
<td>PHYS 101</td>
<td>MECHANICS (WITH LAB)</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 103</td>
<td>MECHANICS DISCUSSION</td>
<td></td>
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<tr>
<td>PHYS 111</td>
<td>HONORS MECHANICS (WITH LAB)</td>
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<tbody>
<tr>
<td>PHYS 102</td>
<td>ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
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<tr>
<td>&amp; PHYS 104</td>
<td>ELECTRICITY AND MAGNETISM DISCUSSION</td>
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</tr>
<tr>
<td>PHYS 112</td>
<td>HONORS ELECTRICITY &amp; MAGNETISM (WITH LAB)</td>
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</tr>
<tr>
<td>PHYS 201</td>
<td>WAVES, LIGHT, AND HEAT</td>
<td>3</td>
</tr>
</tbody>
</table>
PHYS 202 MODERN PHYSICS 3
PHYS 231 ELEMENTARY PHYSICS LAB 1
PHYS 301 INTERMEDIATE MECHANICS 4
PHYS 311 INTRODUCTION TO QUANTUM PHYSICS I 3
PHYS 491 & PHYS 493 UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR 4 3
PHYS 492 & PHYS 494 UNDERGRADUATE RESEARCH and UNDERGRADUATE RESEARCH SEMINAR 5 3

Major Concentration in Applied Physics 6

PHYS 302 INTERMEDIATE ELECTRODYNAMICS 4
PHYS 312 or ELEC 361 INTRODUCTION TO QUANTUM PHYSICS II or QUANTUM MECHANICS FOR ENGINEERS 3
PHYS 332 JUNIOR PHYSICS LAB II 2
ELEC 364 PHOTONICS MEASUREMENTS: PRINCIPLES AND PRACTICE 3
PHYS 412 SOLID STATE PHYSICS 7 3
PHYS 425 STATISTICAL & THERMAL PHYSICS 3
ELEC 242 or ELEC 244 & ELEC 243 or ELEC 243 SIGNALS, SYSTEMS, AND TRANSFORMS and ANALOG CIRCUITS LABORATORY ELECTRONIC MEASUREMENT SYSTEMS 4
ELEC 305 INTRODUCTION TO PHYSICAL ELECTRONICS II 3
MATH 381 or CMOR 304 INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS or DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING 3

Total Credit Hours for the Major in Physics and a Major Concentration in Applied Physics 68

Additional Credit Hours to Complete Degree Requirements 1 21
University Graduation Requirements (31)

Total Credit Hours 120

Footnotes and Additional Information

* Note: University Graduation Requirements include 31 credit hours, comprised of Distribution Requirements (Groups I, II, and III), FWIS, and LPAP coursework. In some instances, courses satisfying FWIS or distribution requirements may additionally meet other requirements, such as the Analyzing Diversity (AD) requirement, or some of the student’s declared major, minor, or certificate requirements. Additional Credit Hours to Complete Degree Requirements include general electives, coursework completed as upper-level, residency (hours taken at Rice), and/or any other additional academic program requirements.

1 Students without credit for basic calculus (e.g. MATH 101/MATH 105 and/or MATH 102/MATH 106) must either enroll in the relevant course(s) or substitute more advanced MATH or CMOR coursework, with prior approval by the Physics and Astronomy department’s Undergraduate Program Committee, to earn the required credit.

2 The Physics department has determined that credit awarded for PHYS 141 CONCEPTS IN PHYSICS I is not eligible for meeting the requirements of the Physics major.

3 The Physics department has determined that credit awarded for PHYS 142 CONCEPTS IN PHYSICS II is not eligible for meeting the requirements of the Physics major.

4 PHYS 491 and PHYS 493 must be taken concurrently.

5 PHYS 492 and PHYS 494 must be taken concurrently.

6 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 the requirements for each major concentration for the BS degree in Physics.

7 Or approved substitute in applied physics.

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

Program Restrictions and Exclusions

Students pursuing the BS Degree with a Major in Physics and a Major Concentration in Applied Physics should be aware of the following program restrictions:

- As noted in Majors, Minors, and Certificates (https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/) under Declaring Majors, Minors and Certificates, students may not obtain both a BA and a BS in the same major. Students pursuing the BS Degree with a Major in Physics and a Major Concentration in Applied Physics may not additionally pursue the BA Degree with a Major in Physics.
- Students pursuing the major in Physics may pursue only one major concentration within the major.
- As noted in Majors, Minors, and Certificates (https://ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/), students may not major and minor in the same subject.

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 (https://oaa.rice.edu/advising-network/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 departmental 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 Applied 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 click on the Research tab on the department website (https://physics.rice.edu/).

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