

**LEHMAN COLLEGE
OF THE
CITY UNIVERSITY OF NEW YORK**

DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

Name of Program and Degree Award: Physics / B.S.

Hegis Number: 1902.00

Program Code: 34031

Effective Term: Fall 2015

1. **Type of Change:** Course Requirements for the B.S. Physics Program

2. **From:**

Physics, B.S. (54 Credit Major)

The B.S. ~~degree~~ program in Physics is designed for students who are planning a career in physics research and/or college- ~~and university-~~level teaching. Any student following this program may select the B.A. degree instead of the B.S. degree. The minimum of 54 required credits is distributed ~~among the following courses (students receiving credit toward a major in Physics for either PHY 166 or 168 may not also receive credit for PHY 135):~~

Credits (54)

~~In required PHY courses: in one of the following combinations: 24 credits: PHY 168 (5), 169 (5), 251 (2), 300 (4), 301 (4), 302 (4) and 12 credits in additional PHY courses at the 200 level or above; or, with Chair's permission, 24 credits: PHY 166 (5), 167 (5), 251 (2), 300 (4), 301 (4), 302 (4)] and 12 credits in additional PHY courses at the 200 level or above; or, with Chair's permission, 23 credits: PHY 135 (4) and 167 (5), 251 (2), 300 (4), 301 (4), 302 (4) and 13 credits in additional PHY courses at the 200 level or above.~~

48

~~In mathematics courses: MAT 175-176 (8), MAT 226 (4), and two additional 3-credit MAT courses.~~

3. To:

Physics, B.S. (60 Credit Major)

The B.S. program in Physics is designed for students who are planning a career in physics research and/or college-level teaching. Any student following this program may select the B.A. degree instead of the B.S. degree. The minimum of 60 required credits is distributed as follows:

Credits (60)

36 Required PHY courses: PHY 168, 169, 207, 251, 300, 301, 302, 303, 400. With permission from the Chair students may take PHY 166, 167 in place of PHY 168, 169.

6 At least two additional PHY or AST courses at the 200 level or above. With permission from the Chair one of these additional courses may be at the 100 level.

12 Required MAT courses: MAT 175, 176, 226.

6 At least two additional MAT courses at the 200 level or above.

4. Rationale:

These changes are designed to (i) strengthen the training students receive during their first two years of the program to make them better-prepared for the upper-level physics courses, (ii) ensure that during their second two years students receive a comprehensive physics education. To achieve the first goal the required physics courses now include the calculus-based physics sequence PHY 168, 169 as well as a new Mathematics for the Physical Sciences course PHY 207. To achieve the second goal the number of required physics courses has been increased to include PHY 303 (thermodynamics and statistical mechanics) and PHY 400 (quantum mechanics). The number of credits required for the degree has been increased from 54 to 60 so there is room for six physics elective credits. To give the students some flexibility the freedom to use a 100-level course to count as an elective has been introduced.

5. Date of departmental approval:

February 10, 2015

**LEHMAN COLLEGE
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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

Name of Program and Degree Award: Physics / B.A.

Hegis Number: 1902.00

Program Code: 34052

Effective Term: Fall 2015

1. **Type of Change:** Course Requirements for the B.A. Physics Program

2. **From:**

Physics, B.A. (~~36~~ Credit Major)

The B.A. program in Physics is designed for students who, although not planning a career in physics research and/or college/university-level teaching, have a strong interest in physical science, particularly physics, and wish to prepare for a career in which a good basic knowledge of physics is useful. Among such careers are the health professions, elementary and secondary school science teaching, patent-law practice, industrial management, and science journalism.

Credits (~~36~~)

24

In required PHY courses: in one of the following three combinations:

~~10 credits in PHY 168-169 and 14 credits in additional PHY courses;~~

~~or with Chair's permission either:~~

~~10 credits in PHY166-167 and 14 credits in additional PHY courses at the 200 level or above; or~~

~~9 credits in PHY 135 and 167, and 15 credits in additional PHY courses at 200 level or above;~~

12

In required mathematics courses: MAT 175-176 and MAT 226.

3. To:

Physics, B.A. (38 Credit Major)

The B.A. program in Physics is designed for students who, although not planning a career in physics research or college-level teaching, have a strong interest in physical science, particularly physics, and wish to prepare for a career in which a good basic knowledge of physics is useful. Among such careers are the health professions, elementary and secondary school science teaching, patent-law practice, industrial management, and science journalism. The minimum of 38 required credits is distributed as follows:

Credits (38)

14 Required PHY courses: PHY 168, 169, 207. With permission from the Chair students may take PHY 166, 167 in place of PHY 168, 169.

12 At least four additional PHY or AST courses at the 200 level or above. With permission from the Chair one of these additional courses may be at the 100 level.

12 Required MAT courses: MAT 175, 176, 226.

4. **Rationale:**

The change is designed to strengthen the preparation students receive during their first two years in the program, steering them toward the calculus-based physics sequence PHY 168, 169 and requiring PHY 207 - Mathematics for the Physical Sciences. A previous track in which students took PHY 135, 167 has been eliminated since 135 does not provide adequate preparation for 167. The change is also designed to increase flexibility by allowing a 100-level course to count as an elective. To maintain standards we have compensated for this flexibility by increasing the total number of credits from 36 to 38.

5. **Date of departmental approval:**

February 10, 2015

**LEHMAN COLLEGE
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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

Name of Program and Degree Award: Physics / Minor

Hegis Number: 1902.00

Program Code: 34031-m

Effective Term: Fall 2015

1. **Type of Change:** Course Requirements for the Minor in Physics Program

2. **From:**

Minor in Physics

~~A minor in Physics consists of either PHY 166 and 167 or PHY 168 and 169, or, with chair's permission, PHY 135 and 167, and at least 12 credit hours of courses at the 200-level or above.~~

3. **To:**

Minor in Physics (19 Credit Minor)

The Minor in Physics is designed for students who are interested in physics and want to go beyond the basic introductory courses. The minimum of 19 required credits is distributed as follows.

10 Required PHY courses: either PHY 166, 167 or PHY 168, 169.

9 At least three additional PHY or AST courses at the 200 level or above. With permission from the Chair one of these additional courses may be at the 100 level.

4. Rationale:

This change is designed to increase flexibility, by allowing a 100-level course such as AST 101 - Introduction to Astronomy to count as an elective. It also eliminates a previous track in which students took PHY 135 and 167 since PHY 135 does not adequately prepare students for 167.

5. Date of departmental approval:

February 10, 2015

**LEHMAN COLLEGE
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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

1. **Type of Change:** Change in course description (note added)

2. **From:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Astronomy
Course Prefix & Number	AST 101
Course Title	Introduction to Astronomy
Description	Basic exploration of our universe and the laws that govern it. History and origins of the universe, life-cycles of stars and galaxies, properties of the sun and planets, the motion of the earth and its effect on seasons and astronomical observation.
Pre/ Co Requisites	None
Credits	3
Hours	3

Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input checked="" type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input checked="" type="checkbox"/> Scientific World

3. To:

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Astronomy

Course Prefix & Number	AST 101
Course Title	Introduction to Astronomy
Description	Basic exploration of our universe and the laws that govern it. History and origins of the universe, life-cycles of stars and galaxies, properties of the sun and planets, the motion of the earth and its effect on seasons and astronomical observation. <u>Note: Only one of the following courses may be taken for credit: AST 101 or AST 117.</u>
Pre/ Co Requisites	None
Credits	3
Hours	3
Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input checked="" type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input checked="" type="checkbox"/> Scientific World

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4. **Rationale:**

A restriction has been added against taking both AST 101 and AST 117 for credit since the subject material covered in these two courses has considerable overlap. (The only significant distinction is that the courses are offered in a different format: AST 117 has a lab in addition to the lecture component.) This will have no effect on learning outcomes.

5. **Date of departmental approval:**

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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

1. **Type of Change:** Change in course description

2. **From:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Astronomy
Course Prefix & Number	AST 117
Course Title	Astronomy of Stellar Systems
Description	Stars, interstellar matter, and stellar systems. Pulsars and quasars. Introduction to modern theories of stellar evolution and cosmology.
Pre/ Co Requisites	None
Credits	4
Hours	5

Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

3. **To:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Astronomy

Course Prefix & Number	AST 117
Course Title	Astronomy of Stellar Systems
Description	<u>Exploration of our universe covering basic properties of stellar systems, including planetary systems, stars, stellar evolution and remnants, galaxies and cosmology. Note: Only one of the following courses may be taken for credit: AST 101 or AST 117.</u>
Pre/ Co Requisites	None
Credits	4
Hours	5
Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity

	<input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
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4. **Rationale:**

The course description has been altered to better reflect the current content of the course and align it with the stated learning outcomes. Also a restriction has been added against taking both AST 101 and AST 117 for credit since the subject material covered in these two courses has considerable overlap. (The only significant distinction is that the courses are offered in a different format: AST 117 has a lab in addition to the lecture component.)

5. **Date of departmental approval:**

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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

1. **Type of Change:** Change in course title

2. **From:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Physics
Course Prefix & Number	PHY 168
Course Title	Introductory Physics I
Description	(Calculus-based Physics: Designed for those preparing for careers in the physical sciences and engineering.) Motion, Newton's laws, work and energy, mechanics of rigid bodies, elasticity, mechanics of fluids, temperature, heat, kinetic theory of matter, wave motion, and sound.
Pre/ Co Requisites	MAT 175 or departmental permission
Credits	5

Hours	6
Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

3. **To:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial

Subject Area	Physics
Course Prefix & Number	PHY 168
Course Title	<u>Physics I for Scientists and Engineers</u>
Description	
Pre/ Co Requisites	
Credits	
Hours	
Liberal Arts	<input type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society

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4. **Rationale:**

This represents a change in title for the calculus-based physics course PHY 168. The current title for this course, Introductory Physics I, conveys no information about the appropriate audience and leads to confusion with the algebra-based course PHY 166 - General Physics I.

5. **Date of departmental approval:**

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CURRICULUM CHANGE

1. **Type of Change:** Change in course title

2. **From:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Physics
Course Prefix & Number	PHY 169
Course Title	Introductory Physics II
Description	(Calculus-based Physics: Designed for those preparing for careers in the physical sciences and engineering.) Electrostatics, electrodynamics, geometrical and physical optics.
Pre/ Co Requisites	Prerequisite: PHY 168 or departmental permission. Pre- or co-requisite: MAT 176.
Credits	5
Hours	6

Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

3. **To:**

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Physics

Course Prefix & Number	PHY 169
Course Title	<u>Physics II for Scientists and Engineers</u>
Description	
Pre/ Co Requisites	
Credits	
Hours	
Liberal Arts	<input type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, WAC, etc)	
General Education Component	<input type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

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4. **Rationale:**

This represents a change in title for the calculus-based physics course PHY 169. The current title for this course, Introductory Physics II, conveys no information about the appropriate audience and leads to confusion with the algebra-based course PHY 167 - General Physics II.

5. **Date of departmental approval:**

February 10, 2015

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DEPARTMENT OF PHYSICS AND ASTRONOMY

CURRICULUM CHANGE

1. **Type of change:** New Course

2.

Department(s)	Physics and Astronomy
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Physics
Course Prefix & Number	PHY 207
Course Title	Mathematics for the Physical Sciences
Description	Mathematical techniques applied to solving physical problems. Techniques used include differential and integral calculus of one and many variables, infinite series, complex numbers, functions of complex variables, vector calculus, matrices and determinants, linear vector spaces, differential equations.
Pre/ Co Requisites	PREREQ: MAT 176 or permission of the instructor
Credits	4
Hours	4
Liberal Arts	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Course Attribute (e.g. Writing Intensive,	

WAC, etc)	
General Education Component	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

3. **Rationale:**

Although there is a substantial mathematics requirement for majors in physics (MAT 175, 176, 226, and two additional three credit courses), we have found that many of our upper level students are lacking in many of the necessary mathematical problem solving techniques that specifically address the needs of students of the physical sciences. The new course, as we conceive it, is to be an intense “basic training” in mathematics experience with applications drawn from the physical sciences, which will prepare our students for advanced courses more rapidly than is possible currently. In fact, the textbook we plan to assign for the course is Basic Training in Mathematics, A Fitness Program for Science Students by R. Shankar who introduced a similar course for students at Yale University many years ago. The mathematics requirement for physics majors will not be affected by the addition of this course.

4. **Learning Outcomes (By the end of the course students will be expected to):**

Use the mathematical techniques learned to solve problems that arise in the context of the physical sciences, specifically problems in mechanics,

electromagnetic theory, thermodynamics and statistical physics, and quantum mechanics.

5. **Date of Departmental Approval:**

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CURRICULUM CHANGE

1. Type of Change:

Withdrawal of the following courses:

AST 116: Stellar Astronomy

AST 160: Current Topics - Astronomy

PHY 100: Problem Solving – Physical Sciences

PHY 112: Lab for PHY 166 168

PHY 122: Lab for PHY 167 169

PHY 226: Analytical mechanics - Engineers

2. Description:

No description of these courses is available. They do not appear in the college bulletin.

3. Rationale:

These courses are not required for any program. They have not been offered in many years and the Department does not plan to offer them in the future.

4. **Date of departmental approval:**

February 10, 2015