UNIVERSITY FACULTY SENATE FORMS

Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

Submitted by: _Norbert Mulders_____phone number X3517_____

Department: _Physics and Astronomy _____email address mulders@udel.edu

Date: 11/07/2010_____

Action: Revise major_____
(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Effective term_____11F_____
(use format 04F, 05W)

Current degree__BS_____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: __BS_____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name:_____
Proposed new name for revised or new major / minor / concentration / academic unit (if applicable)

Revising or Deleting:

Undergraduate major / Concentration: Physics_ _____
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor:_____
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change:_____
(**Must attach** your Graduate Program Policy Statement)

Graduate Program of Study:_____
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration:_____

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, highlighting the changes made to the original policy document.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?
(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the

Course Challenge list. If there are no new courses enter "None")

None

Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: http://www.ugs.udel.edu/gened/

Identify other units affected by the proposed changes:
(Attach permission from the affected units. If no other unit is affected, enter "None")

None, has negligible impact on the enrolment in CHEM103 or CISC106

Describe the rationale for the proposed program change(s):
(Explain your reasons for creating, revising, or deleting the curriculum or program.)

See attached documents

Program Requirements:
(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.)

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson _____ Date _____

Dean of College _____ Date _____

Chairperson, College Curriculum Committee _____ Date _____

Chairperson, Senate Com. on UG or GR Studies _____ Date _____

Chairperson, Senate Coordinating Com. _____ Date _____

Secretary, Faculty Senate _____ Date _____

Date of Senate Resolution _____ Date to be Effective _____

Registrar _____ Program Code _____ Date _____

Vice Provost for Academic Affairs & International Programs _____ Date _____

Provost _____ Date _____

Board of Trustee Notification _____ Date _____

Revised 02/09/2009 /khs

CURRENT VERSION

DEGREE: BACHELOR OF SCIENCE
MAJOR: PHYSICS

CURRICULUM		CREDITS
UNIVERSITY REQUIREMENTS		
ENGL 110 (minimum grade C-)	Critical Reading and Writing	3
First Year Experience (FYE)		0-4
University Breadth Requirement		12
Discovery Learning Experience (DLE)		3
Multi-cultural Courses		3

COLLEGE REQUIREMENTS

Writing: (minimum grade C-) 3

A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement.)

College of Arts and Sciences Breadth Requirements: (minimum grade C-)

The College Breadth Requirements are in addition to the University Breadth Requirement. Up to 3 credits from each of the University Breadth Requirement categories may be used to simultaneously satisfy these College of Arts and Sciences Breadth Requirements.

A total of eighteen credits from Groups A, B and C is required with a minimum of six credits in each group. The six credits from each group could be from the same area. 18

Group A: Creative Arts and Humanities

Group B: History and Cultural Change.

Group C: Social and Behavioral Sciences

MAJOR REQUIREMENTS

Within the Department

Ordinarily, no more than four credits from among PHYS 201 and PHYS 207 may be counted toward graduation requirements; similarly no more than four from among PHYS 202, PHYS 208. Students interested in majoring in Physics who have taken an introductory sequence other than PHYS 207/PHYS 208 should consult with a member of the Physics faculty to consider the need for additional introductory courses, for which some additional credit toward graduation may be given with permission of the Physics chair. All 200-level PHYS courses used to satisfy prerequisite or graduation requirements must be passed with a minimum grade of C-.

PHYS 169	Perspectives: Physics and Astronomy	1

PHYS 207/PHYS 208	Fundamentals of Physics I and II	8
PHYS 211	Oscillations and Waves	3
PHYS 309	20th/21st Century Physics	3
PHYS 310	Introduction to Thermal Physics	3
PHYS 313	Physical Optics	4
PHYS 419	Classical Mechanics I	3
PHYS 424	Quantum Mechanics	3
PHYS 603	Electricity and Magnetism I	3
Additional credits of Physics at or above the 400 level		15
MATH 241/MATH 242/ MATH 243	Analytic Geometry and Calculus A, B and C	12
BISC 207	Introductory Biology	4
One of the following:		6
MATH 302/MATH 349	Ordinary Differential Equations and Elementary Linear Algebra	
MATH 341/MATH 342	Differential Equations with Linear Algebra	
One of the following:		4-5
CHEM 103	General Chemistry	4
CHEM 111/CHEM 119	General Chemistry and Quantitative Chemistry	5
Foreign Language or Computer Science:		0-12

Completion of the intermediate-level course (107 or 112) in a given foreign language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

Or,

Completion of the following Computer Science sequence:

CISC 106 or CISC 108	General Computer Science for Engineers or Introduction to Computer Science I	3
CISC 181	Introduction to Computer Science II	3
CISC 220	Data Structures	3
Additional credits of Computer Science at or above the 260 level		3

ELECTIVES

After required courses are completed, sufficient elective credits must be taken to meet the minimum credit requirement for the degree.

CREDITS TO TOTAL A MINIMUM OF	124

PROPOSED VERSION

DEGREE: BACHELOR OF SCIENCE
MAJOR: PHYSICS

CURRICULUM		CREDITS
UNIVERSITY REQUIREMENTS		
ENGL 110 (minimum grade C-)	Critical Reading and Writing	3
First Year Experience (FYE)		0-4
University Breadth Requirement		12
Discovery Learning Experience (DLE)		3
Multi-cultural Courses		3

COLLEGE REQUIREMENTS

Writing: (minimum grade C-) 3

A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement.)

College of Arts and Sciences Breadth Requirements: (minimum grade C-)

The College Breadth Requirements are in addition to the University Breadth Requirement. Up to 3 credits from each of the University Breadth Requirement categories may be used to simultaneously satisfy these College of Arts and Sciences Breadth Requirements.

A total of eighteen credits from Groups A, B and C is required with a minimum of six credits in each group. The six credits from each group could be from the same area. 18

Group A: Creative Arts and Humanities

Group B: History and Cultural Change.

Group C: Social and Behavioral Sciences

MAJOR REQUIREMENTS

Within the Department

All 200-level PHYS courses used to satisfy prerequisite or graduation requirements must be passed with a minimum grade of C-.

PHYS 169	Perspectives: Physics and Astronomy	1
PHYS 207/PHYS 208	Fundamentals of Physics I and II	8
PHYS 211	Oscillations and Waves	3
PHYS 309	20th/21st Century Physics	3

PHYS 310	Introduction to Thermal Physics	3
PHYS311	Aspects of Modern Physics	3
PHYS 313	Physical Optics	4
PHYS 419	Classical Mechanics I	3
PHYS 424	Quantum Mechanics	3
PHYS 603	Electricity and Magnetism I	3
Additional credits of Physics at or above the 400 level		15
MATH 241/MATH 242/ MATH 243	Analytic Geometry and Calculus A, B and C	12
One of the following:		6
MATH 302/MATH 349	Ordinary Differential Equations and Elementary Linear Algebra	
MATH 341/MATH 342	Differential Equations with Linear Algebra	

CHEM 103	General Chemistry	4
CISC106	General Computer Science for Engineers	3

Foreign Language or Computer Science: 0-12

Completion of the intermediate-level course (107 or 112) in a given foreign language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

Or,

Completion of the following Computer Science sequence:

CISC 106	General Computer Science for Engineers	3
CISC 181	Introduction to Computer Science II	3
CISC 220	Data Structures	3
Additional credits of Computer Science at or above the 260 level		3

ELECTIVES

After required courses are completed, sufficient elective credits must be taken to meet the minimum credit requirement for the degree.

CREDITS TO TOTAL A MINIMUM OF 124

Revisions of the Physics BS and BA programs

Proposed changes

1) Remove all references to PHYS 201 and PHYS 202 as well as to MATH 221 and MATH 222 from all physics degree programs.

2) Strengthen the BS degrees by
    a. Making CHEM 103 a required course for both BS programs, to be taken in the freshman year, preferably in the first semester.
    b. Making CISC 106 a required course for both BS programs, to be taken no later than the Fall semester of the sophomore year.
    c. Making PHYS 311, Aspects of Modern Physics a required course for both BS programs. This course would normally be taken in the second semester of the sophomore year.

3) Strengthening the BA degrees by
    a. Making CHEM 103 a required course for both BA programs, to be taken in the freshman year, preferably in the first semester.
    b. Making CISC 106 a required course for both BA programs, to be taken no later than the Fall semester of the sophomore year.

Rationale

Removal of PHYS 201 and PHYS 202 as well as to MATH 221 and MATH 222 as courses acceptable for a degree in physics. These courses don **not at all** provide an appropriate starting point for the PHYS300 and PHYS400 level courses.

CHEM 103. In physics courses, especially at the 300 and 400 level, the assumption is made that students are thoroughly familiar with concepts that one would normally encounter in an introductory chemistry course. However, some fraction of our majors report that they have never taken a chemistry course, and many of those who have taken a chemistry course clearly did not retain all that much. CHEM 103 is a required course for the regular BS degree. We should make sure that *all* students take this course, and that they take it *before* they take the physics courses that make use the material covered in CHEM 103.

CISC106. We do believe that everyone who graduates with a physics degree should have had some exposure to computer science, and should have some minimal skills regarding the use of computers. We would also like to make much more use of computational methods in our 300 and 400 level physics courses. A recent survey of the incoming class revealed that experience with programming is rare. The need to incorporate a course that teaches students some basic computer and programming skills seems self-evident. CISC 106 is designed to provide science and engineering majors with exactly that skill set.

PHYS 311. For several years now students in the graduating class have commented on the fact that significant parts of modern physics are not covered anywhere in the curriculum, namely basic solid state physics, nuclear physics, and introductions to elementary particle physics, general relativity and cosmology. We have indeed the bizarre situation that students can graduate without ever having

heard about crystal structure, nuclear decay, the Standard Model or cosmic background radiation. Currently, PHYS309 provides an introduction to special relativity and to quantum mechanics at the level of a typical "Modern Physics" text. PHYS 311 continues at that level, completing the modern physics sequence.

BA degrees. The main reason for changes to the BA degrees is to make sure that the students who start on this track have the appropriate background for the PHYS300 and 400 level courses. We also want to make sure that those students can seamlessly switch over to the BS track, as this happens with great regularity.

Implementation

1. To make sure that CHEM 103 and CISC 106 are taken early on, proper prerequisites should be added to the PHYS300 level courses. Specifically, PHYS 309 and PHYS 310 should have CHEM 103 as prerequisite. PHYS 313 and possibly other courses, such as PHYS 460, PHYS 424, and PHYS 446 should have CISC 106 as prerequisite.

2. CHEM 103 and CISC 106 should be added as required courses for the BA in physics. There is enough space in this program to make that possible.

3. The BA in Physics Education already requires CHEM 103. CISC 106 should be added as a required course. Again, there is enough space in this program.

4. The BS in Physics would acquire two new courses, namely CISC 106 and PHYS 311. To compensate somewhat, BISC 207 will be dropped as a required course. (Note that this course is not particularly popular. The students do not really see the need and take it late in their undergraduate career. The course does not support any of the higher level physics courses.)

5. The program that would be most impacted by the proposed changes is the BS in Physics with a concentration in Astronomy. This concentration currently does not require CHEM or BISC courses. By making CHEM 103, CSIC 106 and PHYS311 required courses, 11 credits are added to this program. One way we can handle this is by taking out the 12 credits of MATH/PHYS at or above the 300 level, and adding PHYS603. This will also remove the peculiar situation that students can graduate with a BS in Physics having seen electrodynamics only at the PHYS 208 level.