

College Curriculum Proposal Approval and Routing Form

TITLE OF PROPOSAL: Change of existing Physics Pre-Health (PHYP) to Biophysics/Pre-Health major

Originating Faculty: Armin Kargol

Department/College: Physics Chairperson: Armin Kargol

Contact Phone/Email: x3645 akargol@loyno.edu

Type of Proposal (Check all that apply):

New Major¹ ☐ New Minor ☐ New Concentration ☐ Revise Existing Program ☒

New Course ☐ Change to Existing Course ☐ Discontinue Program ☐

Undergraduate ☒ Graduate ☐ Online ☐ Professional & Cont. Studies ☐ Other ☐

1. Resources and Fees:

If this is a proposed revision, are there existing fees? No ☒ Yes ☐ \$

Will course or program fees be required for this course/program? No ☒ Yes ☐ \$

Are new resources needed for implementing this proposal? No ☒ Yes ☐

If yes, include complete description and dollar amount in proposal.

2. College Review and Approvals:

a. Department/School (Chair) Date:
Approved ☐ Not Approved ☐

b. College Curriculum Committee (Chair) Date:
Approved ☐ Not Approved ☐

c. College Dean Date:
Supported ☐ Not Supported ☐

3. Intercollegiate Review and Recommendations Required as applicable to proposal:

a. Online Education Committee (Chair) Date:
Recommended ☐ Not Recommended ☐

b. Professional and Continuing Studies Committee (Chair) Date:
Recommended ☐ Not Recommended ☐

c. Graduate Council (Chair) Date:
Recommended ☐ Not Recommended ☐

4. University² Recommendations Required as applicable to proposal:

a. University Courses & Curriculum Committee (Chair) Date:
Recommended ☐ Not Recommended ☐

b. Standing Council for Academic Planning (Chair) Date:
Recommended ☐ Not Recommended ☐

¹ New Degree to be Offered---Requires SACS Notification 6 Months Prior to Start

² Approval by the Strategic Planning Team, University Budget Committee, and/or Board of Trustees may be required for proposals that have significant impact on resources or mission. Proposals to establish or discontinue degree programs require approval by Board of Trustees and SACS.

COLLEGE PROGRAM PROPOSAL FORM

Instructions: Use this form for all single discipline program proposals. Use the Interdisciplinary Program Proposal Form for interdisciplinary program proposals.

Title of Program: Change of existing Physics Pre-Health (PHYP) to Biophysics/Pre-Health major

Originating Faculty Member: Armin Kargol _____

Department: Physics _____ Chairperson: Armin Kargol

Contact Phone and Email: x3645 akargol@loyno.edu _____

This is a _____ new program x modification of existing program requirements.

Summary Description of Proposal:

B.S. in Biophysics programs are offered by several Jesuit institutions, including University of Scranton, Xavier University in Cincinnati, and Loyola Chicago. The latter, for instance, has achieved a remarkable improvement in enrollment in the physics program in the last decade, which can be partially attributed to the newly opened Biophysics track. This trend is a reflection of increasingly interdisciplinary nature of natural sciences and of the demands of the job market. We propose to introduce a B.S. in Biophysics option at Loyola by replacing our existing Physics Pre-Health (PHYP) major with a Biophysics/Pre-Health major. This will create a better focused program rooted in faculty research expertise in areas of physics such as cellular biophysics or biomechanics, while at the same time creating a more flexible program serving needs of a larger population of potential students, including pre-health students as well as other students interested in careers in other biomedical fields.

Current PHYP program shares a core of 8 physics courses (4 introductory and 4 advanced) and 5 mathematics courses with all other physics tracks. In addition, PHYP requires typical chemistry and biology courses: Gen Chem I and II with lab, Organic Chem I and II with lab, Cells and Heredity with lab and Biology of Organisms with lab, similar to all other pre-health majors at Loyola.

The new Biophysics/Pre-Health track will include the following modifications of the advanced courses in the PHYP curriculum:

1. The number of required advanced physics courses will be reduced from 4 to 3, i.e. students will be required to take Classical Mechanics, Advanced Laboratory Physics and one of the following two: Electromagnetism (EM) or Quantum Physics, but not both. This will reduce the number of required credits by 4.
2. Two additional biophysics courses will be required (addition of 6 credits to the total requirement). Students will select from the following options: Cellular Biophysics (PHYS A436), Biomechanics and Neural Control (new course), Artificial Intelligence (new course). These courses will also be available to all other physics majors as Advanced Physics Electives.
3. One additional advanced Biology, Chemistry, or Physics course approved by the advisor will be required. This is additional 3 cr.
4. The number of General Electives will be reduced from 13 to 8 while the total credits required for graduation remain at 120.

This proposal will not require any additional credit hours to be offered in the department because we will creatively use the Advanced Physics Electives (APE). The details are included in section III of this proposal.

Proposals for programs will be reviewed using the following criteria. The order of the criteria does not imply any ranking of the various items. While all criteria may not be satisfied, all criteria must be addressed in a proposal.

I. Brief Background of the Program Development

Provide a brief overview of the background and significance or foundation that influenced the development of the program.

The Physics Program was thoroughly revised in 2006-7 and two new majors (Pre-Health, and Liberal Arts Physics) were introduced in addition to the existing two (Physics, 3+2 Pre-Engineering). The Liberal Arts Physics (PHYL) was intended for students that require a solid foundation in physics but plan careers in other fields (e.g. law) and thus need more scheduling flexibility and more general electives, as well as students who select physics late (e.g. midway through their first year) but still want to graduate in four years. The Pre-Health Physics (PHYP) was intended to attract students interested in physics who plan health-related careers. As we argued then we expected these new majors to contribute to the rebuilding of the Physics Program. Since then the size of the Physics Program has been steadily growing and PHYP are now 30% of all physics majors, second only to PHYS major (35%). Recently, we reviewed the changes made 10 years ago and compared ourselves to successful physics programs at Jesuit and other similar size institutions. Many of these institutions now offer computational physics and biophysics majors, in addition to regular physics tracks. This is in response to the career opportunities in biomedical fields as well as demands of the future workplace. Based on these observations as well as the research expertise of our faculty we propose to replace the existing Pre-Health with the Biophysics/Pre-Health track.

II. Description of the Program

Please organize the proposal utilizing the headings below. The text within each heading can be modified to better meet unit needs/dimensions.

1. Mission

Describe the ways in which the program responds directly or indirectly to the mission of the unit (e.g., department, division, college) and the university.

The Department of Physics trains students in the science of physics and allows them to participate in physics research. The mission of the Physics Department at Loyola University New Orleans is twofold:

- to increase understanding of the physical universe through fundamental research involving faculty and students,
- to offer students insights into our understanding of, and modes of thought about, the physical universe by offering a challenging curriculum taught by a dedicated faculty readily accessible to students and interested in their scholarly welfare.

We offer excellent instruction in all areas of physics to help Loyola undergraduate physics majors, other pre-professional, and non-science majors, learn college-level physics by offering a comprehensive curriculum. It is also the mission of the department to prepare Loyola students for further study or careers in physics, or related disciplines such as chemistry, geology, engineering, environmental science, medicine, and astronomy. The department also helps non-science majors to become empowered with a basic understanding of physics and its applications to societal issues and the physical world.

The new major will be a significant step towards improving our graduates' preparation for medical schools, other graduate programs in biomedical sciences and engineering, or entering the work force. The modified major offers a better mix of physics, chemistry and biology courses and allow students to tailor the courses to their particular career goals.

2. Alignment with the College and University Strategic Plan

Describe ways in which the proposed program aligns with and will contribute to the unit (e.g., department, division, college) and University's strategic plans.

The new program is aligned with the University strategic plan's focus on collaborative research. The program is rooted in the research expertise of physics faculty in various areas of biophysics, such as cellular biophysics, biomechanics, neural networks and complex systems. Biophysics students will be encouraged to engage in research projects with faculty in these areas and that will offer them better preparation for future careers.

3. Projected Demand

- a. Evidence, quantitative and qualitative data, regarding the potential demand for the

proposed program, based on internal information and/or comparisons with peer programs (e.g., informed opinion and source, data-driven from published reports, anecdotal information)

Student headcount in the physics program has been steadily increasing in the past five years, despite the overall losses suffered by Loyola. The Pre-Health Physics program has been a major contributor to this trend and currently PHYP students constitute about 30% of our overall population. We expect that the proposed Biophysics/Pre Health program will attract even more pre-health students. In addition, we will expand the pool of prospective students to include those interested in other, non-MD, biomedical fields, such as medical physics or biomedical engineering. The new major will offer excellent preparation to a wider variety of graduate programs in natural sciences and engineering. The program will also offer students new skills valued by prospective employers. For instance, in Dr. Kargol's biophysics lab students learn the technique of patch clamping, widely used in pharmaceutical industry for screening of potential therapeutic agents. Recently, the lab purchased a state-of-the-art automated patch-clamping instrument that will be available to biophysics students through the Cellular Biophysics course or research projects. Such a skill will open new employment opportunities to our graduates.

Once the change of the major is approved we intend to request Marketing and Admissions assistance in developing marketing strategies and materials to attract students to this program.

- b. Trend Data. Provide projected enrollment statistics including numbers of majors and/or minors and full time equivalent (FTE) student enrollment;

Student headcount in PHYP (11-15 data provided by OIRE, 16 data from dept. sources)

11F – 3

12F – 1

13F – 2

14F – 4

15F – 6

16F – 9

We anticipate that with aggressive marketing this new program has a potential of

attracting at least 2-3 new students every year, increasing the overall size of the physics program by 10 students in the next four years.

- c. Provide any other relevant information regarding potential market for the proposed program.

See 3a.

- d. If available from the Office of Institutional Research and Effectiveness (OIRE), provide national trend data for degrees awarded over the last five years.

4. Relationship to Other Existing Programs

- a. Describe ways in which the proposed program will enhance/complement existing programs and curricula, including potential service to majors, minors, other programs and/or the Loyola Core.

The Pre-Health Physics (PHYP) major was intended to attract students who show strong interest in physics and mathematics but envision careers in health professions. The proposed major will reach out to the same candidate pool but will also attract other students interested in careers in medical physics (non-MD), biophysics, and biomedical engineering.

- b. Describe ways in which the proposed program overlaps with other existing programs.

The new program is a modification of the existing program and does not overlap other existing programs.

5. Adequacy and appropriateness of resource utilization

Evaluate the availability of resources to meet the program's priorities and build strengths. Provide information regarding:

- a. Financial Plan including:
 - i. Annual operating budget
 - ii. Actual or potential external grants
 - iii. Contributions to and impact on fundraising
 - iv. Plan for profit sharing, if applicable

v. Accreditation or certification expenses

The proposed program will not require any new resources. No resources were allocated specifically to the existing PHYP program. All budgets for PHYP are part of the overall Physics Department budget and no changes are required for the proposed modification of PHYP.

- b. Current faculty resources, including those available through consortial agreements, and number of new faculty required (may involve a stepped approach depending on enrollment projections)

No new faculty resources are required. The proposed program is based on existing faculty resources in terms of numbers and expertise.

- c. Administrative support staff resources

No additional administrative support needed.

- d. Space requirements (including both instructional space and administrative support space) and classroom technology

No additional space requirements.

- e. Course development expenses

No course development expenses. All new courses proposed will be developed as the Advanced Physics Electives.

- f. Library

- i. Information and instructional technology resources (e.g., books, journals, databases, learning management system capabilities, streaming media, videoconferencing, classroom capture)
- ii. Confirm that discussion with library representatives has taken place to assure appropriate resources are available.

No new library resources required.

- g. Information Technology and other Technology Needs (e.g., network capacity, lab software, computers, etc.)

No new IT and other technology resources required.

- h. Other academic support services

None

6. Assessment – Projected

- a. Provide the program's projected assessment plan that includes student learning outcomes, process of implementation, and results;
- b. Provide the results of any external reviews or plans for reviews, if available;
- c. Describe the structure and process for administrative and academic oversight;

All assessment, review and oversight plans will be the same as for the existing PHYP major.

III. Impact on the Curriculum:

- a. Provide copies of the old and new Degree Course Program Lists (DPCL), Progression Plan (PP), or equivalent

See attached comparison table between the existing PHYP major and the proposed Biophysics/Pre-Health major (Appendix A).

- b. Provide the following information

i. New Programs

This is not a new program, it is a modification of an existing program.

1. Specify whether any new courses will be offered, and whether this will increase the total number of courses or sections offered by the department
2. To what extent will any new courses for this program impact upon resources in the departments and programs in which these faculty are teaching? Will any new courses replace courses currently offered? Will any such courses prevent an important or required course from being offered in a given semester?
3. Will there be a service learning component? Description of this component to be provided by director of service learning.
4. If new courses will not increase the overall number of offerings, specify which course(s) or section(s) will be dropped in a given semester to create room.
5. Specify any anticipated impact on enrollments in other courses or sections within the department and whether or not this program will

prevent an important or required course from being offered in a given semester.

ii. Existing programs

1. Review your current course offerings and requirements in light of the proposed change. How will the proposed change or changes improve your program and enhance the educational outcomes you seek to accomplish?

The proposed program will be a modification of the existing PHYP major, with changes affecting only the advanced courses. The comparison table in Appendix A details all the changes. The aim of the changes is to create a better focused major addressing the needs of pre-health physics students but also allowing a degree of flexibility that was not present in the current PHYP major. Specifically, the changes will reduce the number of required core physics courses by allowing them to take either EM or Quantum Physics, but not requiring both, as the current PHYP major does. On the other hand the students will be asked to take specific Advanced Physics Elective courses (two of the three courses designated as biophysics APE), as well as one additional advanced course from Biology, Chemistry or Physics. Depending on the students' preferences or career plans they may choose e.g. advanced Cell Biology, Molecular Genetics, Biochemistry. Some students may choose the remaining physics core course (EM or Quantum Physics) in which case their curriculum would be the same as the current PHYP. Yet other students may elect to take the third biophysics APE (as explained earlier the program requires two out of available three biophysics APE). This degree of flexibility will allow the students to create a curriculum better suited to their career plans. Whether it is a medical school, a graduate school in biophysics, an engineering program in biomedical engineering, etc., or entering the workforce directly after graduation, the students will be able to modify the proportion of biology/chemistry/physics courses in their curriculum to some degree. The focus will still be on core physics courses, thus ensuring a proper background in physics but there will be an added flexibility in other areas. The new program graduates will have superior quantitative analysis skills developed through their physics and mathematics courses, as well as solid background in chemistry and biology.

The only new courses will be the three biophysics courses, of which students choose two. Among these three courses, one (Cellular Biophysics PHYS A436) is already in the bulletin and offered on a rotating basis as an Advanced Physics Elective, and the other two (Biomechanics and Neural Control, and Artificial Intelligence) are entirely new. These three courses will have an interesting synergy exposing students to physical basis of biological control systems at different levels, from molecular level through complex systems. The courses are also closely related to the research programs of our faculty members (Dr. Kargol in Cell Biophysics, Dr. Biswas in Biomechanics, and Dr. Rousseau in Robotics and Artificial Intelligence) and will prepare students for collaborative research which is one of the cornerstones of Loyola's QEP. These courses will not increase the total number of courses offered by the department. As part of the requirement for all other physics majors and minors, students select a number (between 1 and 3, depending on the program) of Advanced Physics Electives during their sophomore, junior or senior year. These courses are offered on a rotating basis from a pool of approved advanced elective courses. Each of the three biophysics courses will be offered once every three years and will also serve as an Advanced Physics Elective option for all other physics students. In other words, in every three year cycle the department will offer six APE courses (one per semester), three of which will be the biophysics courses and three others will be in other areas of physics. This way the Biophysics students will have an option of taking each of the three biophysics courses and other physics students will be able to select other courses, not related to biophysics, if they choose so. All this will be accomplished within current course offering numbers.

2. How will proposed change impact the major/adjunct/elective hour distribution requirement for the major or program?

See appendix A.

3. Specify whether any new courses will be offered, and whether this will increase the total number of courses or sections offered by the department.

As explained in sec. III ii 1, the required biophysics courses will be offered as the Advanced Physics Electives, and either already exist or will be created as APE, serving both the Biophysics majors (as required courses) or other physics majors and minors (as electives). There will be no change in the number of course sections offered by the department.

4. To what extent will any new courses for this program impact upon resources in the departments and programs in which these faculty are teaching? Will any new courses replace courses currently offered? Will any such courses prevent an important or required course from being offered in a given semester?

The biophysics courses are either currently offered on a rotating basis as Advanced Physics Electives or will be offered to other students as APE. They will not replace any currently offered courses and will not prevent any current courses from being offered.

6. Will there be a service learning component? Description of this component to be provided by director of service learning.

No.

7. If new courses will not increase the overall number of offerings, specify which course(s) or section(s) will be dropped in a given semester to create room.

The new courses will be offered as Advanced Physics Electives. No courses will be dropped.

8. Specify any anticipated impact on enrollments in other courses or sections within the department and whether or not this program will prevent an important or required course from being offered in a given semester.

The department currently offers one Advanced Physics Elective course every semester. Some of the currently offered AFE already are in biophysics. With the proposed change, in every three year period half of the AFE courses will be in biophysics, half – in other areas. This will not impact overall enrollment in AFE courses. Depending on the student preferences, some AFE courses may have higher enrollment than others.

9. Assess the impact of the proposed change on other departments, especially those serviced by your department or program and those that provide adjunct service to your department or program.

This modification affects only advanced physics courses and therefore will not affect any department nor program serviced by Physics. Current PHYP students are required to take certain mathematics, biology, and chemistry adjunct courses. This will remain unchanged. In addition, the modified major will require one additional advanced elective chosen from biology, chemistry or physics courses approved by the advisor. Depending on the enrollment in the modified program this may result in a modest increase in enrollment in some of these courses.

- c. All proposals must be accompanied by a supporting letter from the chair confirming the department's support.

IV. New Course Proposals

- a. List titles of any new courses created for this program.
 - Biomechanics and Neural Control (new course, Advanced Physics Elective)
 - Artificial Intelligence (new course, Advanced Physics Elective)
- b. Attach proposals for all new courses including assessment plan, learning outcomes and complete syllabus, each with a Course Proposal cover sheet.

See attached.

Include as appendix a copy of the projected Degree Program Course List (DPCL), Progression Plan (PP), or equivalent for each program of study.

Appendix A

DPCL comparison: existing PHYP and proposed Biophysics/Pre-Health programs

Category	Current PHYP	Cr	Proposed Biophys/Pre Health	Cr
Loyola Core				
Foundation	FYS	3	FYS	3

	Engl T122	3	Engl T122	3
	Math A257 Calc I	4	Math A257 Calc I	4
	Sci I: Gen Chem I and Gen Chem Lab I	3+1	Sci I: Gen Chem I and Gen Chem Lab I	3+1
Knowledge/ Values	Creative Arts and Cultures	3	Creative Arts and Cultures	3
	Hist I+II	3+3	Hist I+II	3+3
	Phil I+II	3+3	Phil I+II	3+3
	Rels I+II	3+3	Rels I+II	3+3
	Social Science	3	Social Science	3
	Writing About Lit	3	Writing About Lit	3
Subtotal		41		41
Major				
	Intro Phys Eng	1	Intro Phys Eng	1
	Intro Mech	4	Intro Mech	4
	Mech Lab	1	Mech Lab	1
	Intro EM	4	Intro EM	4
	EM Lab	1	EM Lab	1
	Intro Waves and QP	4	Intro Waves and QP	4
	Intro Thermal	3	Intro Thermal	3
	Class Mech	4	Class Mech	4
	EM	4	EM or Quantum	4
	Adv. Lab	3	Adv. Lab	3
	Quantum	4	Choose 2 from: Cell Biophys Biomechanics Artificial Intelligence	6
Subtotal		33		35
Adjunct				

	Intro Linear Alg	3	Intro Linear Alg	3
	Calc II	4	Calc II	4
	Calc III	3	Calc III	3
	Intro Diff Eq	3	Intro Diff Eq	3
	Cells & Heredity w/lab	3+1	Cells & Heredity w/lab	3+1
	Biol of Organisms w/lab	3+1	Biol of Organisms w/lab	3+1
	Gen Chem II w/lab	3+1	Gen Chem II w/lab	3+1
	Organic I	3	Organic I	3
	Organic Lab	2	Organic Lab	2
	Organic II	3	Organic II	3
			One additional advanced BIOL, CHEM or PHYS elective approved by the advisor	3
Subtotal		33		36
General Electives				
		13		9
Grand Total		120		120

Degree Program Course List (DPCL) of major requirements for students entering Loyola in 2016-17*

B.S. PHYSICS PRE-HEALTH - PHY-P

DATE:

NAME:

ALEKS MATH COURSE PLACEMENT		MAJOR.....33 Crs	ADJUNCT.....33 Crs	NOTES:
English Composition Placement is:	76-100, MathA257, Calculus I	Intro to Physics and Engineering	Intro Linear Algebra	Courses used in the major cannot also be used to satisfy requirements for a minor: Non-major courses WILL be applied to minors as appropriate.
ACT ENGL score 21 or above		A120	Math-A200	
SAT Verbal score 501 or above		Intro Mechanics	Calculus II	
Register for ENGL-T122	46-75, MathA118, Pre-Calculus	A101	Math-A258	
ACT ENGL score 20 or below		Mechanics Lab	Calculus III	
SAT Verbal score 500 or below	0-45, MathA092, Fundamentals of Algebra	A103	Math-A259	GPA: Must achieve 2.0 in Major, Minor (if declared), and Loyola cumulative.
Register for ENGL-A100	(not counted in final degree credits)	Intro EM & Relativity	Intro Differential Equations	
		A102	Math-A310	
		EM Lab	Cells & Heredity:	
		A104	Biol-A106 - Lec	
		Intro Waves and Quant.	Biol-A107 - Lab	Loyola Core requirements are governed by the catalog year that a student is admitted.
		A240	Biol of Organisms:	
		Intro Thermal Physics	Biol-A108 - Lec	
		A241	Biol-A109 - Lab	
		Classical Mechanics	General Chemistry II:	
		A340	Chem-A106 - Lec	
		Electricity and Magnetism	Chem-A108 - Lab	
		A350	Organic Chem I	
		Adv. Laboratory Physics	Chem-A300	
		A445	Organic Chem I - Lab	
		Quantum Mechanics	Chem-A305	GENERAL ELECTIVE.....13 Crs
		A450	Organic Chem II	
			Chem-A301	
		</		

English Composition Placement is:		ALEKS MATH COURSE PLACEMENT	MAJOR.....35 Crs	ADJUNCT.....36 Crs	NOTES:
ACT ENGL score 21 or above		76-100, MathA257, Calculus I	Intro to Physics and Engineering	Into Linear Algebra	Courses used in the major cannot also be used to satisfy requirements for a minor.
SAT Verbal score 501 or above		46-75, MathA118, Pre-Calculus	A120	Math-A200	Non-major courses WILL be applied to minors as appropriate.
Register for ENGL-T122			Intro Mechanics	Calculus II	
ACT ENGL score 20 or below			A101	Math-A258	
SAT Verbal score 500 or below		0-45, MathA092, Fundamentals of Algebra <i>(not counted in final degree credits)</i>	Mechanics Lab	Calculus III	
Register for ENGL-A100			A103	Math-A259	
			Intro EM & Relativity	Intro Differential Equations	GPA: Must achieve 2.0 in Major, Minor (if declared) and Loyola cumulative.
LOYOLA CORE - 41 Credits			A102	Math-A310	
			EM Lab	Cells & Heredity:	Loyola Core requirements are governed by the catalog year that a student is admitted.
			A104	Biol-A106 - Lec	
			Intro Waves and Quant.	Biol-A107 - Lab	
			A240	Biol of Organisms:	
			Intro Thermal Physics	Biol-A108 - Lec	
			A241	Biol-A109 - Lab	
			Classical Mechanics	General Chemistry II:	
			A340	Chem-A106 - Lec	
			Choose one:	Chem-A108 - Lab	
			Electricity and Magnetism - A350 or Quantum Mechanics - A450	Organic Chem I	
				Chem-A300	
				Organic Chem I - Lab	
				Chem-A305	
			Adv. Laboratory Physics	Organic Chem II	
			A445	Chem-A301	
			Choose two:	Additional Advanced BIOL, CHEM, or PHYS elective approved by advisor	
			Cellular Biophysics - A436		
			Biomechanics - A### or Artificial Intelligence - A###		
				GENERAL ELECTIVE.....8 Crs	
			Loyola Core.....41 crs		
			Major.....35 crs		
			Adjunct36 crs		
			General Elective.....8 crs		
			Total120 crs		