THEORETICAL PHYSICS AND APPLIED MATHEMATICS/ APPLIED STATISTICS (BS/MS)

The Accelerated Bachelor's Master's program allows undergraduate students to receive their Master's Degree in a total of five years. Students apply in their junior year and must complete all requirements for the undergraduate and graduate programs. They are able to finish the program in only one additional year by double counting up to 9 credits in their senior year towards both their Undergraduate Degree and their Master's Degree.

CURRICULUM

AP Credit Policies (https://catalog.luc.edu/undergraduate/arts-sciences/mathematics-statistics/#policiestext)

Code	Title	Hours
BS Requirements		
Mathematics Course Requirements		
MATH 161	Calculus I	4
MATH 162	Calculus II	4
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
MATH 212	Linear Algebra	3
MATH 263	Multivariable Calculus	4
MATH 264	Ordinary Differential Equations	3
MATH 313	Abstract Algebra	3
MATH 351	Introduction to Real Analysis I	3
MATH 353	Introductory Complex Analysis	3
PHYS 130	Introduction to Computational Physics	3
or MATH 215	Object-Oriented Programming with Mathematics	
Physics Course Requirements		
PHYS 121	College Physics I with Calculus Lecture/ Discussion	3
PHYS 111L	College Physics Laboratory I	1
PHYS 122	College Physics II with Calculus Lecture/ Discussion	3
PHYS 112L	College Physics Lab II	1
PHYS 126F	Freshman Projects	1
PHYS 235	Modern Physics	3
PHYS 235L	Modern Physics Laboratory	1
PHYS 301	Mathematical Methods in Physics	3
PHYS 314	Theoretical Mechanics I	3
PHYS 351	Electricity and Magnetism I	3
PHYS 328	Thermal Physical & Statistical Mechanics	3
PHYS 338	Advanced Physics Laboratory	2
PHYS 361	Quantum Mechanics I	3
MS Requirements		
STAT 401	Introduction to Applied Statistics Using R	1
STAT 403	SAS Program & Applied Statistics	3
STAT 404	Probability & Statistics I	3
STAT 405	Probability & Statistics II	3
STAT 407	Statistical Design	3
STAT 408	Applied Regression Analysis	3
STAT 495	Statistical Consulting Capstone	2
Select Four (4) Elective Courses		12
STAT 406	Stochastic Processes	
STAT 410	Categorical Data Analysis	
STAT 411	Applied Survival Analysis	
STAT 421	Math Modeling & Simulation	
STAT 426	Advanced Statistical Inference	
STAT 436	Topics in Biostatistics	
STAT 438	Introduction to Predictive Analytics	
STAT 444	Longitudinal Data Analysis and Mixed Modeling	
STAT 451	Applied Nonparametric Methods	
STAT 488	Topics in Statistics	
STAT 498	Independent Study Statistics	
Total Hours		**93**

Suggested Sequence of Courses

The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection.

Course	Title	Hours
First Year		
Fall		
PHYS 121	College Physics I with Calculus Lecture/ Discussion	3
PHYS 111L	College Physics Laboratory I	1
MATH 161	Calculus I	4
UCWR 110	Writing Responsibly	3
Core		3
	Hours	**14**
Spring		
PHYS 122	College Physics II with Calculus Lecture/ Discussion	3
PHYS 112L	College Physics Lab II	1
PHYS 126F	Freshman Projects	1
MATH 162	Calculus II	4
COMP 215 / MATH 215 or PHYS 130	Object Oriented Programming with Mathematics or Introduction to Computational Physics	3
Core		3
	Hours	**15**
Second Year		
Fall		
PHYS 235	Modern Physics	3
PHYS 235L	Modern Physics Laboratory	1
MATH 263	Multivariable Calculus	4
MATH 264	Ordinary Differential Equations	3
Core		3
	Hours	**14**

Spring		
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
MATH 212	Linear Algebra	3
PHYS 314	Theoretical Mechanics I	3
PHYS 301	Mathematical Methods in Physics	3
Core		3
	Hours	**15**
Third Year		
Fall		
PHYS 351	Electricity and Magnetism I	3
MATH 313	Abstract Algebra	3
MATH 351	Introduction to Real Analysis I	3
Core		3
General Elective		3
	Hours	**15**
Spring		
PHYS 361	Quantum Mechanics I	3
Core		3
Core		3
Core		3
General Elective		3
	Hours	**15**
Fourth Year		
Fall		
MATH 353	Introductory Complex Analysis	3
PHYS 328	Thermal Physical & Statistical Mechanics	3
Core		3
Core		3
Core		3
	Hours	**15**
Spring		
PHYS 338	Advanced Physics Laboratory	2
Core		3
Core		3
400-level Major Course		3
400-level Major Course		3
400-level Major Course		3
	Hours	**17**
Fifth Year		
Complete MS requirements in consultation with the Graduate Program Director.		21
	Hours	**21**
	Total Hours	**141**

Guidelines for Accelerated Bachelor's/Master's Programs

Terms

- Accelerated Bachelor's/Master's programs: In this type of program, students share limited credits between their undergraduate and graduate degrees to facilitate completion of both degrees.
- Shared credits: Graduate level credit hours taken during the undergraduate program and then applied towards graduate program requirements will be referred to as shared credits.

Admission Requirements

Accelerated Bachelor's/Master's programs are designed to enhance opportunities for advanced training for Loyola's undergraduates. Admission to these programs must be competitive and will depend upon a positive review of credentials by the program's admissions committee. Accordingly, the admission requirements for these programs may be higher than those required if the master's degree were pursued entirely after the receipt of a bachelor's degree. That is, programs may choose to have more stringent admissions requirements in addition to those minimal requirements below.

Requirements:

- Declared appropriate undergraduate major,
- By the time students begin taking graduate courses as an undergraduate, the student has completed approximately 90 credit hours, or the credit hours required in a program that is accredited by a specialty organization,[1]
- A minimum cumulative GPA for coursework at Loyola that is at or above the program-specific requirements, a minimum major GPA that is at or above the program-specific requirements, and/or appropriate designated coursework for evaluation of student readiness in their discipline.[2]

Students not eligible for the Accelerated Bachelor's/Master's program (e.g., students who have not declared the appropriate undergraduate major) may apply to the master's program through the regular admissions process. Students enrolled in an Accelerated Bachelor's/Master's program who choose not to continue to the master's degree program upon completion of the bachelor's degree will face no consequences.[3]

Ideally, a student will apply for admission (or confirm interest in proceeding towards the graduate degree in opt-out programs) as they approach 90 credit hours. Programs are encouraged to begin advising students early in their major so that they are aware of the program and, if interested, can complete their bachelor's degree requirements in a way that facilitates completion of the program. Once admitted as an undergraduate, Program Directors should ensure that students are enrolled using the plan code associated with the Accelerated Bachelor's/Master's program. Using the plan code associated with the Accelerated Bachelor's/Master's program will ensure that students may be easily identified as they move through the program. Students will not officially matriculate into the master's degree program and be labeled as a graduate student by the university, with accompanying changes to tuition and Financial Aid (see below), until the undergraduate degree has been awarded. Once admitted to the graduate program, students must meet the academic standing requirements of their graduate program as they complete the program curriculum.

1 Programs that have specialized accreditation will adhere to the admissions criteria provided by, or approved by, their specialized accreditors.

2 The program will identify appropriate indicators of student readiness for graduate coursework (e.g., high-level performance in 300 level courses). Recognizing differences between how majors are designed, we do not specify a blanket requirement.

[3] If students choose not to enroll in the Accelerated Bachelor's/Master's program, they still must complete all of the standard requirements associated with the undergraduate degree (e.g., a capstone).

For more information on Admissions requirements, visit here (https://gpem.luc.edu/portal/admission/?tab=home).

Curriculum

Level and progression of courses. The Accelerated Bachelor's/Master's programs are designed to be competitive and attractive to our most capable students. Students admitted to Accelerated Bachelor's/Master's programs should be capable of meeting graduate level learning outcomes. Following guidance from the Higher Learning Commission, only courses taken at the 400 level or higher (including 300/400 level courses taken at the 400 level) will count toward the graduate program.[1,2] Up to 50% of the total graduate level credit hours, required in the graduate program, may come from 300/400 level courses where the student is enrolled in the 400 level of the course. Further, at least 50% of the credit hours for the graduate program must come from courses that are designed for and restricted to graduate students who have been admitted to a graduate program at Loyola (e.g., enrolled in plan code that indicates the Accelerated Bachelor's/Master's program, typically ending with the letter "D").[3]

In general, graduate level coursework should not be taken prior to admission into the Accelerated Bachelor's/Master's program. Exceptions may be granted for professional programs where curriculum for the Accelerated Bachelor's/Master's program is designed to begin earlier. On the recommendation of the program's Graduate Director, students may take one of their graduate level courses before they are admitted to the Accelerated Bachelors/Master's program if they have advanced abilities in their discipline and course offerings warrant such an exception.[4] Undergraduate degree requirements outside of the major are in no way impacted by admission to an Accelerated Bachelor's/Master's program.[5]

Shared credits. Undergraduate courses (i.e., courses offered at the 300 level or below) cannot be counted as shared credits nor count towards the master's degree. Up to 50% of the total graduate level credit hours, required in the graduate program, may be counted in meeting both the undergraduate and graduate degree requirements. Of those shared credits, students in an Accelerated Bachelor's/Master's program should begin their graduate program with the standard introductory course(s) for the program whenever possible. So that students may progress through the Accelerated Bachelor's/Master's program in a timely manner, undergraduate programs are encouraged to design their curriculum such that a student can complete some required graduate credit hours while completing the undergraduate degree. For instance, some of the graduate curriculum should also satisfy electives for the undergraduate major.

The program's Graduate Director will designate credit hours to be shared through the advising form and master's degree conferral review process. Shared credit hours will not be marked on the undergraduate record as having a special status in the undergraduate program. They will be included in the student's undergraduate earned hours and GPA. Graduate credit hours taken during the undergraduate program will not be included in the graduate GPA calculation.

[1] If students wish to transfer credits from another university to Loyola University Chicago, the program's Graduate director will review the relevant syllabus(es) to determine whether it meets the criteria for a 400 level course or higher.

[2] Programs with specialized accreditation requirements that allow programs to offer graduate curriculum to undergraduate students will conform to those specialized accreditation requirements.

[3] In rare cases, the Graduate Director may authorize enrollment in a 400-level course for a highly qualified and highly motivated undergraduate, ensuring that the undergraduate's exceptional participation in the graduate class will not diminish in any way the experience of the graduate students regularly enrolled.

[4] For example, if a particular course is only offered once every 2-3 years, and a student has demonstrated the necessary ability to be successful, the Graduate Director may allow a student to take a graduate level course to be shared prior to the student being formally admitted to the graduate program. See, also, footnote 3.

[5] Students should not, for example, attempt to negotiate themselves out of a writing intensive requirement on the basis of admission to a graduate program.

Graduation

Degrees are awarded sequentially. All details of undergraduate commencement are handled in the ordinary way as for all students in the School/College/Institute. Once in the graduate program, students abide by the graduation deadlines set forth by the graduate program. Students in these programs must be continuously enrolled from undergraduate to graduate degree program unless given explicit permission by their program for a gap year or approved leave of absence.

Learning Outcomes

Learning Outcomes for the BS

Loyola University Chicago's major in Theoretical Physics / Applied Mathematics is an interdisciplinary program that provides extensive training in both physics and mathematics. It prepares students for graduate study in physics, mathematics, or applied mathematics; careers in fields such as engineering or computer science that value quantitative reasoning and mathematical modeling; or technical training in professions like medicine, dentistry, or law.

Students majoring in Theoretical Physics / Applied Mathematics possess a versatile set of skills that are well-suited to data science, numerical modeling, and quantitative analysis. They may pursue careers in higher education, at research institutes or government labs, or in high-tech industries. Recent majors have gone on to world class graduate programs in fields ranging from physics to neuroscience, and programming jobs at major tech companies.

The course of study for the Theoretical Physics / Applied Mathematics major covers the core classes in the Physics major, provides laboratory experience, and adds a comprehensive mathematics component. Upon completion of this program, students will:

1. Exhibit foundational knowledge in both physics and mathematics.
2. Be able to develop and interpret mathematical models that provide both quantitative and qualitative understanding of physical systems.
3. Possess intermediate level laboratory skills that will serve as a foundation for more advanced training in graduate or professional school.
4. Recognize how careful data collection and analysis helps develop or falsify scientific theories.
5. Demonstrate effective and ethical decision-making abilities in issues related to the sciences.

Learning Outcomes for the MS

Upon completion of our MS program in Applied Statistics, students are expected to have:

1. Mastered the art and science of choosing and/or developing the appropriate statistical model(s) for a given dataset-situation, and have mastered the skill of interpreting the chosen model.
2. Received sufficient exposure to basic theorems and proofs used in introductory probability and statistical inference.
3. Worked with data from application fields such as public/global health, medical, industrial and environmental research.
4. Received training to ethically apply statistical training in the real world.
5. Obtained hands-on experience and assimilated course material via our 2cr Statistical Consulting capstone/practicum class.
6. Sufficiently mastered the course and practicum material to either obtain gainful employment in the field of attend a Ph.D. program