Resolution for the Proposal for
A BS in Physics

WHEREAS, the Chemistry and Physics Department proposed to create **a BS Degree in Physics**, and

WHEREAS, student enrollment in the STEM programs at the College has grown substantially in recent years, and

WHEREAS, the proposed program will be a welcome addition to limited STEM degree options at the College, and

WHEREAS, Physics is one of core disciplines in Arts and Sciences, which is widely offered across SUNY Comprehensive Colleges, and

WHEREAS, the growing number of Physics Minors at the College indicates a strong interest among students in this field, and

WHEREAS, the proposed program will offer an opportunity for students to gain fundamental knowledge of Physics through core courses and more specialized knowledge in one of concentrations, including a traditional General Physics concentration and more career-oriented Health Science, Quantitative Finance, and Applied/Computational concentrations,

WHEREAS, a unique and creative set of concentrations of the proposed program will guide students in making connections between academic knowledge and possible career paths, and

WHEREAS, a proposed curriculum includes courses from Biological Sciences, Finance, and Mathematics/CIS, and

WHEREAS, all of these Academic Departments voted to support this proposal, and

WHEREAS, the proposed program can launch with the current faculty,

THEREFORE, BE IT RESOLVED that the Faculty Senate approve **the Proposal for a BS in Physics**

Submitted by Curriculum and Academic Planning Committee (CAP), May 8, 2021
The Program Announcement approved by CAP, May 7, 2021

[CAP Membership]
Tejas Bouklas, Svetlana Jovic, Yu Lei, Matthew Lippert, Anissa Wicktor Lynch, Sheyi Oladipo, Dana Sinclair, Kerry Weir, and Ryoko Yamamoto (Chair)

The Proposal approved by the Faculty Senate by unanimous consent on 5/14/2021.

New Program Proposal: Undergraduate Degree Program

Form 2A

Version 2017-08-28

This form should be used to seek SUNY's approval and New York State Education Department's (SED) registration of a proposed new academic program leading to an associate and/or bachelor's degree. Approval and registration are both required before a proposed program can be promoted or advertised, or can enroll students. The campus Chief Executive or Chief Academic Officer should send a signed cover letter and this completed form (unless a different form applies[1]), which should include appended items that may be required for Sections 1 through 6, 9 and 10 and MPA-1 of this form, to the SUNY Provost at *program.review@suny.edu*. The completed form and appended items should be sent as a single, continuously paginated document.[2] If Sections 7 and 8 of this form apply, External Evaluation Reports and a single Institutional Response should also be sent, but in a separate electronic document. Guidance on academic program planning is available here.

Table of Contents

NOTE: Please update this Table of Contents automatically after the form has been completed. *To do this, put the cursor anywhere over the Table of Contents, right click, and, on the pop-up menus, select "Update Field" and then "Update Page Numbers Only." The last item in the Table of Contents is the List of Appended and/or Accompanying Items, but the actual appended items should continue the pagination.*

[1]Use a **different form** if the proposed new program will lead to a graduate degree or any credit-bearing certificate; be a combination of existing registered programs (i.e. for a multi-award or multi-institution program); be a breakout of a registered track or option in an existing registered program; or **lead to certification as a classroom teacher, school or district leader, or pupil personnel services professional** (e.g., school counselor).

[2]This email address limits attachments to 25 MB. If a file with the proposal and appended materials exceeds that limit, it should be emailed in parts.

Section 1. General Information		
a) Institutional Information	*Date of Proposal:*	Draft (4/23/21)
	Institution's 6-digit SED Code:	**234000**
	Institution's Name:	**SUNY Old Westbury**
	Address:	**PO Box 210, Old Westbury, NY 11568**
	Dept of Labor/Regent's Region:	**Long Island**
b) Program Locations	*List each campus where the entire program will be offered (with each institutional or branch campus 6-digit SED Code):* **SUNY Old Westbury 234000**	
	List the name and address of off-campus locations (i.e., extension sites or extension centers) where courses will offered, ***or check here [X] if not applicable****:*	
c) Proposed Program Information	*Program Title:*	**Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations**
	Award(s) (e.g., A.A., B.S.):	**Bachelor of Science (B.S.)**
	Number of Required Credits:	*Minimum* [**120**] *If tracks or options, largest minimum* [**121**]
	Proposed HEGIS Code:	**1902.00**
	Proposed 6-digit CIP 2010 Code:	**40.0801**
	If the program will be accredited, list the accrediting agency and expected date of accreditation: ***N/A***	
	If applicable, list the SED professional licensure title(s)[3] to which the program leads: ***N/A***	
d) Campus Contact	*Name and title:* **Dr. Duncan Quarless, Provost and Senior Vice President for Academic Affairs** *Telephone:*(**516) 876-3135** *E-mail:* **quarlessd@oldwestbury.edu**	
e) Chief Executive or Chief Academic Officer Approval	***Signature affirms that the proposal has met all applicable campus administrative and shared governance procedures for consultation, and the institution's commitment to support the proposed program. E-signatures are acceptable.*** *Name and title:* **Dr. Duncan Quarless, Provost and Senior Vice President for Academic Affairs** *Signature and date:*	
	If the program will be registered jointly[4] with one or more other institutions, provide the following information for each institution:	
	Partner institution's name and 6-digit SED Code: *Name, title, and signature of partner institution's CEO (or* ***append*** *a signed letter indicating approval of this proposal):*	

[3] If the proposed program leads to a professional license, a specialized form for the specific profession may need to accompany this proposal.
[4] If the partner institution is non-degree-granting, see SED's CEO Memo 94-04.

Attestation and Assurances

On behalf of the institution, I hereby attest to the following:

That all educational activities offered as part of this proposed curriculum are aligned with the institutions' goals and objectives and meet all statutory and regulatory requirements, including but not limited to Parts 50, 52, 53 and 54 of the Rules of the Board of Regents and the following specific requirements:

That credit for study in the proposed program will be granted consistent with the requirements in §50.1(o).

That, consistent with §52.1(b)(3), a reviewing system has been devised to estimate the success of students and faculty in achieving the goals and objectives of the program, including the use of data to inform program improvements.[5]

That, consistent with §52.2(a), the institution possesses the financial resources necessary to accomplish its mission and the purposes of each registered program, provides classrooms and other necessary facilities and equipment as described in §52.2(a)(2) and (3), sufficient for the programs dependent on their use, and provides libraries and library resources and maintains collections sufficient to support the institution and each registered curriculum as provided in §52.2(a)(4), including for the program proposed in this application.

That, consistent with 52.2(b), the information provided in this application demonstrates that the institution is in compliance with the requirements of §52.2(b), relating to faculty.

That all curriculum and courses are offered and all credits are awarded, consistent with the requirements of §52.2(c).

That admissions decisions are made consistent with the requirements of §52.2(d)(1) and (2) of the Regulations of the Commissioner of Education.

That, consistent with §52.2(e) of the Regulations of the Commissioner of Education: overall educational policy and its implementation are the responsibility of the institution's faculty and academic officers, that the institution establishes, publishes and enforces explicit policies as required by §52.2(e)(3), that academic policies applicable to each course as required by §52.2(e)(4), including learning objectives and methods of assessing student achievement, are made explicit by the instructor at the beginning of each term; that the institution provides academic advice to students as required by §52.2(e)(5), that the institution maintains and provides student records as required by §52.2(e)(6).

That, consistent with §52.2(f)(2) of the Regulations of the Commissioner of Education, the institution provides adequate academic support services and that all educational activities offered as part of a registered curriculum meet the requirements established by state, the Rules of the Board of Regents and Part 52 of the Commissioner's regulations.

CHIEF ADMINISTRATIVE or ACADEMIC OFFICER/ PROVOST	
Signature	Date
Type or print the name and title of signatory	Phone Number

[5] The NY State Education Department reserves the right to request this data at any time and to use such data as part of its evaluation of future program registration applications submitted by the institution.

Section 2. Program Information

2.1. Program Format

Check all SED-defined formats, mode and other program features that apply to the **entire program**.

a) Format(s): [ ]Day [ ]Evening [ ]Weekend [ ]Evening/Weekend [ ]Not Full-Time

b) Modes: [ ]Standard [ ]Independent Study [ ]External [ ]Accelerated [ ]Distance Education
NOTE: *If the program is designed to enable students to complete 50% or more of the course requirements through distance education, check Distance Education, see Section 10, and* ***append*** *a Distance Education Format Proposal.*

c) Other: [ ] Bilingual [ ] Language Other Than English [ ] Upper Division [ ] Cooperative [ ] 4.5 year [ ] 5 year

2.2. Related Degree Program

NOTE: *This section is not applicable to a program leading to an associate's or a bachelor's degree.*

2.3. Program Description, Purposes and Planning

a) *What is the description of the program as it will appear in the institution's catalog?*

Physics is the most fundamental of the sciences, investigating the basic laws of nature and asking deep questions about the properties of matter, the origin and fate of the universe, and nature of space and time. Undergraduate training in physics provides a solid grounding in quantitative problem solving, analytical reasoning, and mathematical modeling.

The Bachelor of Science degree in physics has both a standard track and several alternative career-oriented concentrations. All bachelor's students will take the full physics core of foundational courses and upper division core courses. Further advanced courses will be determined by the choice of concentration.

General Physics concentration: A traditional physics B.S. program meant for students intending to continue to graduate school or pursue a career in STEM. Students will take a further two advanced math and two advanced physics courses, for a total of 69 credits.

Health Science concentration: For students pursuing a career in the medical professions. Beyond the physics core curriculum, students will take an additional 21 credits coursework in biology and chemistry that is appropriate for MCAT preparations, for a total of 76 credits.

Quantitative Finance concentration: This track contains an additional 32 credits of coursework in finance and computer science, with a capstone course in econophysics, giving a total of 79 credits.

Applied/Computational concentration: The coursework will consist of the foundational physics core, the upper division core, and an additional 5 courses in mathematics and computer science, for a total of 74 credits.

b) *What are the program's educational and, if appropriate, career objectives, and the program's primary student learning outcomes (SLOs)?* ***NOTE:*** *SLOs are defined by the Middle States Commission on Higher Education in the Characteristics of Excellence in Higher Education (2006) as "clearly articulated written statements, expressed in observable terms, of key learning outcomes: the knowledge, skills and competencies that students are expected to exhibit upon completion of the program."*

Educational objectives:

Students will gain a fundamental understanding of the basic laws of nature and the ability to ask and answer deep questions about the properties of matter, the origin and fate of the universe, and nature of space and time. Students will

receive a solid grounding in quantitative problem solving, analytical reasoning, basic programming, and mathematical modeling.

Career objectives – Students will be prepared to

1. continue to graduate school or pursue a career in STEM. [General Physics concentration]
2. enter a program in medical physics or healthcare. [Health Science concentration]
3. enter the finance industry as an analyst or continue graduate study in a quantitative finance program. [Quantitative Finance concentration]
4. pursue a technical career in STEM, with strong analytical skills, along with experience in electronics, programming, and mathematical modeling. [Applied/Computational concentration]

Student learning objectives - Students will be able to:

1. Understand, recall, and apply the core principles of the laws of physics including classical mechanics, electricity and magnetism, quantum mechanics, relativity, and statistical mechanics.
2. Apply mathematical skills, programming skills and physics concepts together to model physical systems.
3. Apply the process of science and the scientific method including generating theoretical principles, testing hypotheses, experimental design, and developing problem-solving strategies.
4. Collect, evaluate, and interpret experimental data, including having a familiarity with electronics and other equipment commonly used in laboratory settings.
5. Communicate scientific ideas and information clearly in both written and oral formats.

c) *How does the program relate to the institution's and SUNY's mission and strategic goals and priorities? What is the program's importance to the institution, and its relationship to existing and/or projected programs and its expected impact on them? As applicable, how does the program reflect diversity and/or international perspectives? For doctoral programs, what is this program's potential to achieve national and/or international prominence and distinction?*

SUNY Old Westbury's Mission Statement is as follows:

Mission Statement

SUNY Old Westbury is a dynamic and diverse public liberal arts college that fosters academic excellence through close interaction among students, faculty and staff. Old Westbury weaves the values of integrity, community engagement, and global citizenship into the fabric of its academic programs and campus life. In an environment that cultivates critical thinking, empathy, creativity and intercultural understanding, we endeavor to stimulate a passion for learning and a commitment to building a more just and sustainable world. The College is a community of students, teachers, staff, and alumni bound together in mutual support, respect, and dedication to the Mission.

The creation of a Physics B.S. program supports the mission of SUNY OW in variety of ways. Most directly, it addresses being a "public liberal arts college that fosters academic excellence" and creating "an environment that cultivates critical thinking." Physics is a core scientific discipline and is an essential STEM field of study. It has been called the "crown jewel" of science because it lies at the root of all physical phenomena. Moreover, physics requires analytical skills that are applicable to a wide variety of career paths. Studying physics prepares graduates to tackle almost any problem-solving oriented challenge confronting them. This is a motivating factor for the variety of career concentrations that are part of our proposed curriculum.

SUNY OW has experienced strong enrollment growth in STEM related fields in the past decade (from 346 students in 2010 to 622 students in 2020). However, the College unfortunately offers few undergraduate STEM programs. There are currently only five distinct undergraduate STEM programs: biology, biochemistry, chemistry, math, and computer science. Only three of these are in the natural sciences. Physics will make a strong addition to the portfolio of programs and give students another much needed option in STEM and the natural sciences. Our career concentrations compliment, without duplicating, existing programs related to health science and in the school of business.

In the context of SUNY OW's *Strategic Plan 2018-2023* (https://www.oldwestbury.edu/about/president/2018-2023-strategic-plan), the creation of the physics program contributes in a variety of ways. Specifically, it supports Goal 1: Support Student Success, Objective 1A: Improve Student Retention and Completion, Strategy 1A: Expand and renovate teaching and research facilities to meet current and future growth in high-needs STEM degree offerings and related faculty research. It also supports Goal 2: Promote Academic Excellence. The addition of physics is one step in a comprehensive effort to strengthen and broaden the natural sciences at SUNY Old Westbury. Starting in 2022 the Natural Science Building at SUNY OW will undergo a complete renovation, providing modernized, flexible teaching and laboratory spaces and state-of-the-art research and computational facilities. The building is being purposefully re-designed to house a new physics program, with astronomical viewing facilities, updated physics teaching laboratories, flexible instructional computing classrooms, and collaborative student and faculty discussion spaces.

With a mission to promote diversity and social justice, SUNY OW has a long-standing goal of addressing the underrepresentation of minority populations in STEM. The problem is especially acute in physics: out of all bachelor's degrees in physics awarded in 2018, only 4% were granted to African-American students and 8% to Hispanics (American Institute of Physics, "Physics Bachelor's Degrees: 2018", 2020 AIP). SUNY OW is uniquely well positioned to take on this challenge. Old Westbury is the most diverse SUNY campus, is one of the most diverse universities in the country (Study.com, "Top 50 Colleges for Racial and Cultural Diversity", June 2019), and is a leader in promoting social mobility (US News and World Reports, "Top Performers in Social Mobility", 2021). Over one-quarter of the student body described themselves as African-American, and another quarter as Hispanic and SUNY OW was recently officially designated a Hispanic Serving Institution (HSI). The National Science Foundation identified, as one of its 10 Big Ideas (National Science Foundation, Special Report: "NSF's 10 Big Ideas", 2017), attracting, educating, and empowering a diverse STEM workforce, representative of the country, as a top priority. In this way, SUNY OW's and national strategic goals align, and the physics program would be an essential addition in helping SUNY OW contribute to the goal of a diverse STEM workforce.

An excerpt of SUNY's mission statement is as follows.

Mission Statement
The mission of the state university system shall be to provide to the people of New York educational services of the highest quality, with the broadest possible access, fully representative of all segments of the population in a complete range of academic, professional and vocational postsecondary programs including such additional activities in pursuit of these objectives as are necessary or customary. These services and activities shall be offered through a geographically distributed comprehensive system of diverse campuses which shall have differentiated, and designated missions designed to provide a comprehensive program of higher education, to meet the needs of both traditional and non-traditional students and to address local, regional and state needs and goals.

- *recognizes the fundamental role of its responsibilities in undergraduate education and provides a full range of graduate and professional education that reflects the opportunity for individual choice and the needs of society;*

See the rest of the Mission Statement here (https://www.suny.edu/about/mission/).

As one of SUNY's 4-year colleges, Old Westbury has a responsibility to provide a broad-based liberal education, with offerings in all major core disciplines. Physics is a primary example of such a core discipline, and the primacy of physics is recognized at SUNY OW's peer institutions. **SUNY OW is currently one of only three out of the thirteen comprehensive colleges in the SUNY system to not offer a bachelor's degree in Physics.** Moreover, SUNY OW is the only SUNY comprehensive college on Long Island. Given that a central theme of SUNY's mission is educational access, the need for this program is self-evident.

The proposed physics program aligns well with SUNY strategic priorities. The career concentrations in the proposed curriculum directly address the need to "close the gap" between graduation and entry into a successful career path. As part of the career concentrations, internship opportunities and partnerships with local companies will be developed. This is particularly true of the of the Quantitative Finance Concentration. Given the proximity of SUNY OW to New York

City, the financial capital of the world, this concentration will open a direct path for graduates to a career in a major regional industry. The Health Science Concentration addresses the need for more workers in the healthcare industry by preparing students for graduate/professional study in health-related programs. The applied/computational concentration addresses the need for technically skilled workers, particularly in the energy sector. This is especially important given that this sector of the Long Island economy is expected to grow in the coming years, (Long Island Press, July 19, 2019, "NY Announces Nation's Largest Wind Farm to be Built off Long Island", https://www.longislandpress.com/2019/07/19/ny-announces-nations-largest-wind-farm-to-be-built-off-long-island/).

d) *How were faculty involved in the program's design? Describe input by external partners, if any (e.g., employers and institutions offering further education?*

The design of this program was the result of a collaborative effort by the physics faculty in the Chemistry and Physics Department, who oversaw the development throughout its various phases. Furthermore, given the interdisciplinary nature of the program, the Department of Biological Sciences, the School of Business, and especially the Department of Math/CIS were also consulted during the program development at various times.

e) *How did input, if any, from external partners (e.g., educational institutions and employers) or standards influence the program's design? If the program is designed to meet specialized accreditation or other external standards, such as the educational requirements in Commissioner's Regulations for the Profession, **append** a side-by-side chart to show how the program's components meet those external standards. If SED's Office of the Professions requires a specialized form for the profession to which the proposed program leads, **append** a completed form at the end of this document.*

Not applicable

f) *Enter anticipated enrollments for Years 1 through 5 in the table below. How were they determined, and what assumptions were used? What contingencies exist if anticipated enrollments are not achieved?*

Year	Anticipated Headcount Enrollment			Estimated FTE
	Full-time	Part-time	Total	
1	10	2	12	11
2	19	3	22	20.5
3	26	5	31	28.5
4	34	6	40	37
5	34	6	40	37

Determination of total enrollment:
Assume average graduation rate of 7 per year (for undergraduate programs without a master/PhD): (American Institute of Physics, "Size of Undergraduate Physics and Astronomy Programs", July 2020, https://www.aip.org/statistics/reports/size-of-undergraduate-programs-16-18)

Physics Bachelor's Degree–Granting Departments, 2018

	Highest Physics Degree Offered			Overall
	Bachelor's	Master's	PhD	
Number of departments	503	57	194	754
Percent of departments	67%	7%	26%	100%
Three-year average number of bachelor's degrees conferred	7.1	10.1	25.4	12.1
Median number of bachelor's degrees conferred	5	8	17	7

There are an additional eight physics departments that do not grant bachelor's degrees. The bachelor's degree data includes astronomy bachelors at the 45 combined physics and astronomy departments.

AIP Statistics aip.org/statistics

Assume graduation rate of 60%: (National Center for Education Statistics, "Undergraduate Retention and Graduation Rates", April 2020 https://nces.ed.gov/fastfacts/display.asp?id=40)

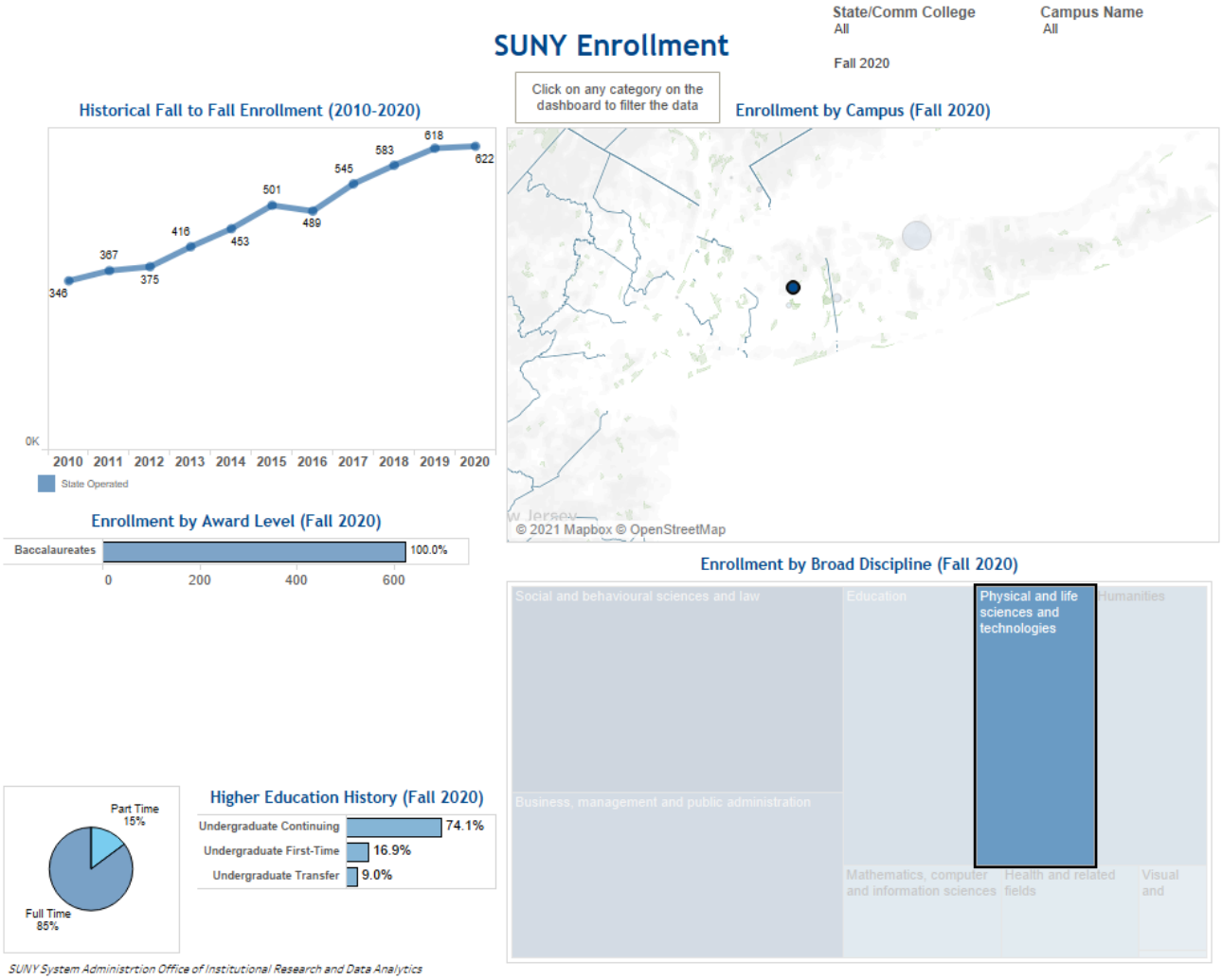
The number of first year students is then: $\mathrm{fy} = 11.67$
Assuming an even dropout rate over four years gives a dropout rate per year of: $\mathrm{d} = 1.17$

The total number of students for each year is then calculated as:

$$\mathrm{year}_n = n\,\mathrm{fy} - \mathrm{d}\,\frac{\mathrm{n}\,(\mathrm{n}-1)}{2} \qquad n < 5$$

$$\mathrm{year}_5 = 5\,\mathrm{fy} - 10\,\mathrm{d} - 7$$

Determination of full-time and part-time enrollment:
The full-time and part-time enrollments were calculated using 85% for full-time and 15% for part-time. These numbers are for the natural and life science students at SUNY Old Westbury (SUNY Old Westbury website, "Fast Facts", https://www.suny.edu/about/fast-facts/)



Contingency:

If the enrollment targets are not met, the program can operate in a reduced capacity using only current faculty.

g) *Outline all curricular requirements for the proposed program, including prerequisite, core, specialization (track, concentration), internship, capstone, and any other relevant component requirements, but do not list each General Education course.*

Course Title	Credits
Foundational Core	
CP 2240 General Physics I	3
CP 2241 General Physics I Lab	1
CP 2250 General Physics II	3
CP 2251 General Physics II Lab	1
CP 2260 General Physics III	3
CP 2261 General Physics III Lab	1
MA 2310 Calculus 1	4
MA 2320 Calculus 2	4
CP 2120 Principles of Chemistry I*	3
CP 2121 Principles of Chemistry I Lab*	1
CP 2130 Principles of Chemistry II*	3
CP 2131 Principles of Chemistry II Lab*	1
Subtotal	28
(Subtotal for Quantitative Finance)	20
Upper Division Core	
CP 3230 Math Methods in the Physical Sciences	3
CP 3600 Mechanics	3
CP 3700 Electromagnetism	3
CP 3800 Relativity	3
CP 3900 Experimental Physics & Electronics Lab	3
CP 4100 Thermodynamics	3
CP 4200 Quantum Mechanics	3
CP 5920 Seminar 1	1
CP 5921 Seminar 2	1
MA 3330 Calculus 3	4
Subtotal	27
General Physics Concentration	
MA 3160 Linear Algebra	4
MA 4360 Differential Equations (or other advanced math course 4000 or above)	4
Two additional advanced physics courses (4000 or above)	6
Concentration Subtotal	14
Applied/Computational Concentration	
CP 4600 Applied Mechanics	3
MA 3030 Discrete Math	4
CS 2510 Computer Programming I	4
CS 2511 Computer Programming II	4
CS 3810 Data Structures & Algorithms	4
Concentration Subtotal	19
*Courses are not required for the Quantitative Finance Concentration	

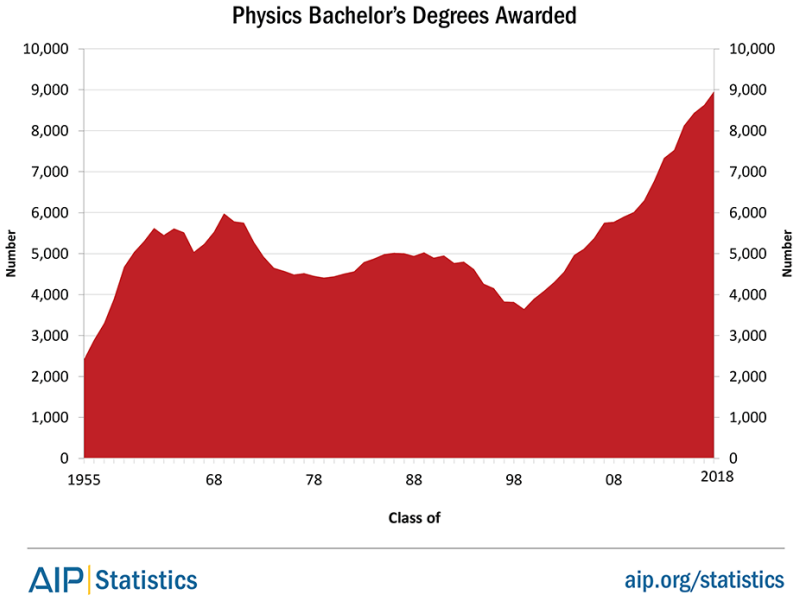
Course Title	Credits
Health Science Concentration	
BS 2400 Basic Biology I	3
BS 2401 Basic Biology I Lab	1
BS 2410 Basic Biology II	3
BS 2411 Basic Biology II Lab	1
CP 3300 Organic Chemistry I	3
CP 3302 Organic Chemistry I Lab	2
CP 3310 Organic Chemistry II	3
CP 3312 Organic Chemistry II Lab	2
CP 4510 Biochemistry I or CP 4490 Biochemistry for Life Sciences	3
Concentration Subtotal	21
Quantitative Finance Concentration	
MA 2000 Applied Statistics	4
MA 3160 Linear Algebra	4
MA 4360 Differential Equations	4
CS 2510 Computer Programming I	4
BU 4762 Financial Management I	4
BU 5740 Investment Management and Security Analysis	4
BU 5789 Futures and Options Markets	4
CP 4900 Econophysics	4
Concentration Subtotal	32
Totals for the B.S. Degree	
General Physics Concentration	
Total for the Major	69
Other General Education Courses	36
Other College Requirements	6
General Electives	9
Total	120
Health Science Concentration	
Total for the Major	76
Other General Education Courses	36
Other College Requirements	6
General Electives	2
Total	120
Quantitative Finance Concentration	
Total for the Major	79
Other General Education Courses	36
Other College Requirements	6
Total	121
Applied/Computational Concentration	
Total for the Major	74
Other General Education Courses	36
Other College Requirements	6
General Electives	4
Total	120

h) *Program Impact on SUNY and New York State*

h)(1) ***Need:*** *What is the need for the proposed program in terms of the clientele it will serve and the educational and/or economic needs of the area and New York State? How was need determined? Why are similar programs, if any, not meeting the need?*

There is tremendous need for more trained physicists in the State of New York. According to the New York State Department of Labor the employment need for physics is projected to increase by 22% from 2016 to 2026. This represents one of the largest projected increases for any occupation in New York State over that time period (NY State Dept of Labor, Long-Term Occupational Employment Projections 2016-2026, https://dol.ny.gov/statistics-statewide-and-regional-long-term-occupational-projections). Nationwide there is growing demand for physicists: According to the Bureau of Labor Statistics, employment for PhD physicists expected to grow 7% in the next 10 years. (U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, Physicists and Astronomers, April 2021, https://www.bls.gov/ooh/life-physical-and-social-science/physicists-and-astronomers.htm)

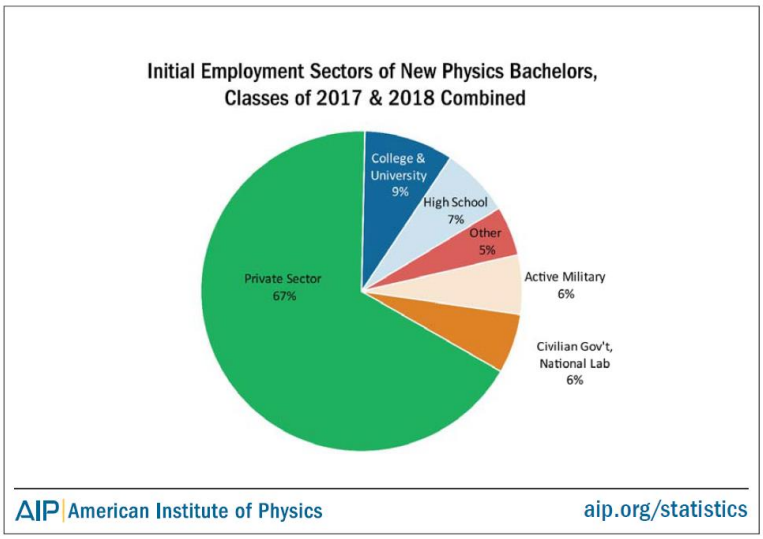
The number of physics bachelor's degrees awarded at US institutions has been increasing steadily for almost two decades, averaging about a 5% increase a year, increasing 145% between 1999 and 2018. In the same period, the number of STEM degrees conferred has increased 80%. In 2017-18, 35% of physics bachelor's recipients graduated with a double major. An increasing number of physics departments offer a curricular focus to their major, accounting for 30% of all physics bachelor's degrees awarded in 2017-18, with engineering being the most popular. (American Institute of Physics, "Physics Bachelor's Degrees 2018:", Aug. 2020, https://www.aip.org/statistics/reports/physics-bachelors-degrees-2018)

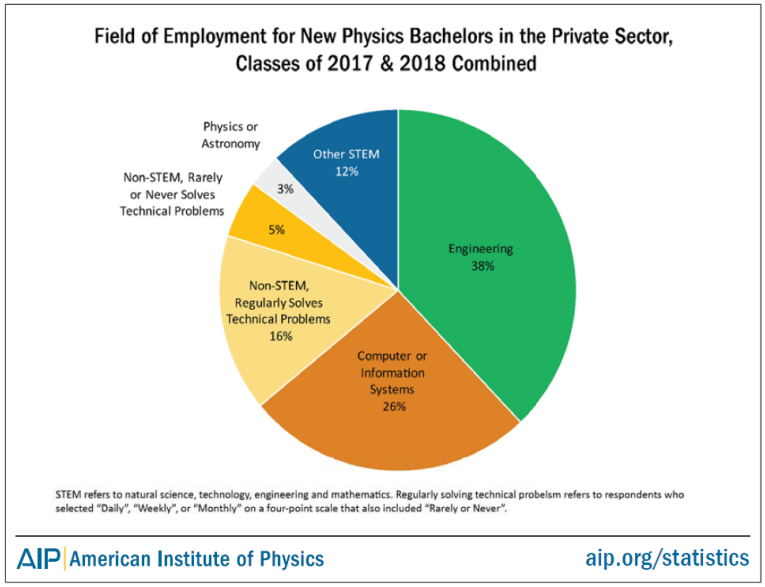


After graduation, physics bachelors follow a variety of career paths. Within one year of receiving a degree from an institution granting only bachelor's degrees, 28% of students enroll in graduate programs in physics or astronomy, 19% in graduate programs in other areas, including engineering, medicine, education, and business.

Undergraduate training in physics provides a solid grounding in quantitative problem solving, analytical reasoning, and mathematical modeling, leading to the diversity of career paths. One year after degree, 48% of physics bachelors are in the workforce, in a variety of fields; including engineering, computers or information systems, high school teachers, as

well as fields outside of STEM. (See the figures below.) (American Institute of Physics, "Employments and Careers in Physics," Apr. 2020, https://www.aip.org/file/src-employment-bookletpdf/download?token=TjIwEfsd).





The demand for quality STEM educators, especially in physics, is enormous and growing. School districts consistently rank physics as the highest need area among all academic disciplines. A background in physics provides a firm scientific foundation upon which to launch a career in education. Teachers with authentic research experience can more effectively incorporate cutting edge research and communicate the process of scientific investigation. They are more able to implement inquiry-based teaching methods, allowing them to bring the excitement of discovery to the next generation of students. Furthermore, the establishment of the physics program at SUNY OW will allow the development of a physics education program as part of SUNY OW's School of Education.

Healthcare is a large and growing segment of the economy, and a firm foundation in quantitative science is necessary for careers in medicine, dentistry, and other health professions. Many health professionals begin their careers in physics, and students with Bachelor's degrees in Physics have some of the highest average MCAT scores. The physical sciences have the highest acceptance rate into medical schools (48%), while in comparison biological sciences have a 42% acceptance rate and health sciences have a 39% acceptance rate. (Association of American Medical Colleges, "2020 FACTS:

Applicants and Matriculants Data", https://www.aamc.org/data-reports/students-residents/interactive-data/2020-facts-applicants-and-matriculants-data)

Financial engineering or quantitative finance is a rapidly growing sector of the financial industry whose epicenter is in New York City. Professionals that work in quantitative finance have rigorous quantitative training and the primary focus of their work is to model particular financial instruments both analytically and numerically. A physics degree is viewed as extremely desirable by employers and a large percentage of those employed in this field come from a physics background. Moreover, employers are developing programs and initiatives to address diversity and inclusion in their workplaces (for example: Goldman Sach, "2019 Diversity and Inclusion", https://www.goldmansachs.com/our-firm/history/moments/2019-diversity-and-inclusion.html). SUNY OW is a minority serving institution, and the physics program, with its quantitative finance concentration, would be uniquely situated to address this call.

Engineering is perhaps the most straightforward of all physics applications. The basic knowledge of mechanical and electrical phenomena which form the basis for most engineering projects are at the heart of physics as a discipline. A physics degree is a strong foundation for any career in engineering.

h)(2) ***Employment:*** *For programs designed to prepare graduates for immediate employment, use the table below to list potential employers of graduates that have requested establishment of the program and state their specific number of positions needed. If letters from employers support the program, they may be* ***appended*** *at the end of this form.*

Employer	*Need: Projected positions*	
	In initial year	In fifth year

h)(3) ***Similar Programs:*** *Use the table below to list similar programs at other institutions, public and independent, in the service area, region and state, as appropriate. Expand the table as needed.* ***NOTE:*** *Detailed program-level information for SUNY institutions is available in the Academic Program Enterprise System (APES) or Academic Program Dashboards. Institutional research and information security officers at your campus should be able to help provide access to these password-protected sites. For non-SUNY programs, program titles and degree information – but no enrollment data – is available from SED's Inventory of Registered Programs.*

Institution	Program Title	Degree	Enrollment
SUNY Stony Brook	Physics	B.S.	293
CUNY Queens College	Physics	B.S.	
CUNY York College	Physics	B.S.	
Hofstra University	Physics	B.S.	
Adelphi University	Physics	B.A./ B.S.	
St. John's University	Physics	B.S.	

h)(4) ***Collaboration:*** *Did this program's design benefit from consultation with other SUNY campuses? If so, what was that consultation and its result?*

The program did not benefit from consultations with any other SUNY campuses.

h)(5) ***Concerns or Objections:*** *If concerns and/or objections were raised by other SUNY campuses, how were they resolved?*

No concerns and/or objections were raised by other SUNY campuses.

h)(6) ***Undergraduate Transfer:*** *The State University views as one of its highest priorities the facilitation of transfer for undergraduate students. To demonstrate adequate planning for transfer under SUNY's student mobility policy,* ***Section 9*** *of this form on* ***SUNY Undergraduate Transfer*** *must be completed for programs leading to Associate in Arts (A.A.) and Associate in Science (A.S.) and for baccalaureate programs anticipating transfer enrollment.*

See Section 9.b.

2.4. Admissions

a) *What are all admission requirements for students in this program? Please note those that differ from the institution's minimum admissions requirements and explain why they differ.*

There are no special admission requirements for this program beyond the College's normal admission requirements.

b) *What is the process for evaluating exceptions to those requirements?*

The evaluation of exceptions to the admissions requirements will follow the same process as that used by the College.

c) *How will the institution encourage enrollment in this program by persons from groups historically underrepresented in the institution, discipline, or occupation?*

Currently the College is a minority serving institution and was recently designated a Hispanic Serving Institution (HSI). The college is committed to inclusiveness and diversity as reflected in its mission statement and its commitment to social justice, and to building a more just and sustainable world. *U.S. News & World Report* has named Old Westbury as fourth in campus ethnic diversity among National Liberal Arts Colleges in the United States. It is the 15th consecutive year the College has ranked among the top colleges where students are most likely to encounter undergraduates from different racial or ethnic groups. (US News and World Report "SUNY-College at Old Westbury's 2020 rankings," https://www.usnews.com/best-colleges/suny-old-westbury-7109)

In 2018, 2019, and 2020, the College received the Higher Education Excellence in Diversity (HEED) Award. The HEED Award is the only national honor recognizing U.S. colleges and universities that demonstrate an outstanding commitment to diversity and inclusion across their campus. This is also captured in Old Westbury's *2018-2023 Strategic Plan* vision statement - "Old Westbury, SUNY's most diverse campus, is a regional academic leader that fosters personal growth and prepares students to embrace the social and environmental responsibilities of our 21st century global community."

	URM	non-URM
All UG	2916 (60%)	1921 (40%)
Biological Sciences	303 (60%)	206 (40%)
Chemistry/Physics	50 (68%)	24 (32%)
Math/Computer Science	148 (51%)	140 (49%)

Fall 2019 enrollment data, *UG: undergraduate; URM: underrepresented minority (African American, Hispanic, Native Hawaiian/Pacific Islander, American Indian/Alaskan Native). Old Westbury Institutional Research.*

2.5. Academic and Other Support Services

Summarize the academic advising and support services available to help students succeed in the program.

Four years ago, the College launched a Student Success initiative with the creation of a Student Success Center where tutoring, peer-mentoring, research opportunities, advising, student completion coaching, transfer student coordinators, and

career planning services are offered in a central location in the Campus Center building. In addition, the College acquired a Student Success application, *EAB Navigate*, linked to the student and faculty portals pairing students in any of the programs housed in the Chemistry and Physics Department with a faculty member in the department. Academic advising is an essential component of each of the department's programs. A faculty advisor will serve as a primary source of information and support during the students' tenure in the program. The advisor serves as a mentor in relation to career planning, plans for future study, academic progress, and other issues that impact students' performance in the program. Majors will be expected to meet regularly with advisors each semester. Such meetings will provide opportunities for both in-depth discussion of personal experiences, including the application of theory to practice, and the implications of research methods and analysis in cultural studies.

Furthermore, all students in the program would have access to the full range of services provided by the College. First Year students receive advising in the First Year Experience program, then move to advising with the Academic Advising Center as sophomores. In coordination with the Student Success Center, both assist students in understanding and meeting the College's academic requirements for graduation, including SUNY General Education and College Liberal Education requirements. They also assist with online degree evaluation, particularly for transfer students who need to understand how their previous coursework has been evaluated. Once students declare their major, they are assigned to faculty department advisors.

Informational Technology Services (ITS) provides all campus-wide technological support in terms of the installation, maintenance and upgrade of hardware and software, and the learning management system (BlackBoard). All students are issued e-mail accounts and server space to store data and files on the campus network. Similarly, faculty members are issued e-mail accounts and server space to store data and files that can be shared at will with students on the campus network. The College provides ample access to computer labs for all students taking courses within the department's programs and WiFi access is available throughout its buildings.

Students also receive academic support from the Writing Center, where assistance and non-credit workshops are provided. Services at the Writing Center have been particularly beneficial to some Biology majors whose first language is not English. Academic support is also provided by the Math Center and the Tutoring Center. In addition, free on-line tutoring is available for any student who might need help in a variety of subjects through Smarthinking.

The Collegiate Science and Technology Entry Program (CSTEP) also offers workshops, research opportunities, information on internships, and peer-tutoring throughout the year.

2.6. Prior Learning Assessment

If this program will grant credit based on Prior Learning Assessment, describe the methods of evaluating the learning and the maximum number of credits allowed, ***or check here [X] if not applicable****.*

2.7. Program Assessment and Improvement

Describe how this program's achievement of its objectives will be assessed, in accordance with SUNY policy, including the date of the program's initial assessment and the length (in years) of the assessment cycle. Explain plans for assessing achievement of students learning outcomes during the program and success after completion of the program. ***Append*** *at the end of this form,* ***a plan or curriculum map*** *showing the courses in which the program's educational and, if appropriate, career objectives – from Item 2.3(b) of this form – will be taught and assessed.* ***NOTE:*** *The University Faculty Senate's Guide for the Evaluation of Undergraduate Programs is a helpful reference.*

In accordance with SUNY policy, the College carries out a departmental Five-Year Program Review process, including an external evaluation. This review process is coordinated by the Curriculum and Academic Planning Committee (CAP,

a Faculty Governance committee). The proposed degree would be reviewed as part of the Chemistry and Physics Department.

Student Learning Outcomes will be assessed annually over the five-year review period and results included in the self-study report. The proposed physics program will be assessed with a comprehensive portfolio of both formative and summative assessment tools. We will make use of available assessment instruments specialized for physics, such as those provided by the APPT (American Association of Physics Teachers) and PhysPort (https://www.physport.org/). We will use a combination of embedded questions, standardized rubrics, and student and faculty surveys.

The SLOs are summarized below.

1. Understand, recall, and apply the core principles of the laws of physics including classical mechanics, electricity and magnetism, quantum mechanics, relativity, and statistical mechanics.
2. Apply mathematical skills, programming skills and physics concepts together to model physical systems.
3. Apply the process of science and the scientific method including generating theoretical principles, testing hypotheses, experimental design, and developing problem-solving strategies.
4. Collect, evaluate, and interpret experimental data, including having a detailed understanding of the electronics and other equipment commonly used in laboratory settings.
5. Communicate scientific ideas and information clearly in both written and oral formats.

A curriculum map indicating in which courses the Student Learning Outcomes will be taught and assessed is attached as Appendix 1. The SLOs will be assessed in CP2260/CP2261 to give a baseline for evaluating progress through the upper division courses. SLO 2 is excluded from this initial assessment. SLO 1 will be assessed using embedded test questions in the upper division courses. SLO 2 will be assessed using embedded test questions and a rubric evaluating student competencies in CP3900. SLO 3 will be assessed using a rubric graded on the student's final project presented in senior seminar (CP5920/CP5921). SLO 4 will be assessed using a rubric evaluating student competencies in CP3900. SLO 3 will be assessed using a rubric graded on the student's presentations and written work presented in senior seminar (CP5920/CP5921). The rubrics will be designed using the Scientific Abilities Assessment Rubrics (SAAR) or similar open educational resources.

Physics majors will be paired up with a faculty mentor and have meetings once a semester. Student engagement will be evaluated through surveys designed around the NSSE or similar resources to be completed by both the faculty and the student after each meeting. Graduation data and follow-up data will be collected through a combination of recording College wide and SUNY wide statistics, as well as student and graduate surveys.

In general, all data will be recorded anonymously. The above assessment strategy is subject to change based on feedback and student needs as well as changes in College, SUNY, and Middle States goals and guidelines.

The Five Year Review self study report will be generated in accordance with current SUNY and Middle States guidelines. A sample outline is as follows:

- Mission and Learning Outcomes
- Program Curriculum and Design
- Students
- Faculty
- Support, Resources and Facilities
- Assessment of SLOs
- External Evaluation and Response
- Improvement Loop

Section 3. Program Schedule and Curriculum

Complete the **SUNY Undergraduate Program Schedule** to show how a typical student may progress through the program. This is the registered curriculum, so please be precise. Enter required courses where applicable and enter generic course types for electives or options. Either complete the blank Schedule that appears in this section, or complete an Excel equivalent that computes all sums for you, and can be found here. Rows for terms that are not required can be deleted.

NOTES: *The **Undergraduate Schedule** must show **all curricular requirements** and demonstrate that the program conforms to SUNY's and SED's policies.*

- *It must show how a student can complete all program requirements within SUNY credit limits, unless a longer period is selected as a format in Item 2.1(c): two years of full-time study (or the equivalent) and 64 credits for an associate degree, or four years of full-time study (or the equivalent) and 126 credits for a bachelor's degree. Bachelor's degree programs should have at least 45 credits of upper division study, with 24 in the major.*
- *It must show how students in A.A., A.S. and bachelor's programs can complete, within the first two years of full-time study (or 60 credits), no fewer than 30 credits in approved SUNY GER courses in the categories of Basic Communication and Mathematics, and in at least 5 of the following 8 categories: Natural Science, Social Science, American History, Western Civilization, Other World Civilizations, Humanities, the Arts and Foreign Languages*
- *It must show how students can complete Liberal Arts and Sciences (LAS) credits appropriate for the degree.*
- *When a SUNY Transfer Path applies to the program, it must show how students can complete the number of SUNY Transfer Path courses shown in the Transfer Path Requirement Summary within the first two years of full-time study (or 60 credits), consistent with SUNY's Student Seamless Transfer policy and MTP 2013-03.*
- *Requests for a program-level waiver of SUNY credit limits, SUNY GER and/or a SUNY Transfer Path require the campus to submit a Waiver Request –with compelling justification(s).*

EXAMPLE FOR ONE TERM: Undergraduate Program Schedule

Term 2: Fall 20xx	Credits per classification						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Prerequisite(s)**
ACC 101 Principles of Accounting	4			4	4		
MAT 111 College Mathematics	3	M	3	3			MAT 110
CMP 101 Introduction to Computers	3						
HUM 110 Speech	3	BC	3			X	
ENG 113 English 102	3	BC	3				
Term credit total:	16	6	9	7	4		

Special Cases for the Program Schedules:

- *For a program with multiple tracks or with multiple schedule options (such as full-time and part-time options), use one Program Schedule for each track or schedule option. Note that licensure qualifying and non-licensure qualifying options cannot be tracks; they must be separate programs.*
- *When this form is used for a multi-award and/or multi-institution program that is not based entirely on existing programs, use the schedule to show how a sample student can complete the proposed program. **NOTE:** Form 3A, Changes to an Existing Program, should be used for new multi-award and/or multi-institution programs that are based entirely on existing programs.*
- *SUNY policy governs the awarding of two degrees at the same level.*
- *Minors require neither SUNY approval nor SED registration.*

a) *If the program will be offered through a nontraditional schedule (i.e., not on a semester calendar), what is the schedule and how does it impact financial aid eligibility? **NOTE:** Consult with your campus financial aid administrator for information about nontraditional schedules and financial aid eligibility.*

Not applicable.

b) *For **each existing course** that is part of the proposed undergraduate major (including cognates and restricted electives, but not including general education), **append a catalog description** at the end of this document.*

See Appendix 2: Course Descriptions.

c) *For **each new course** in the undergraduate program, **append a syllabus** at the end of this document. **NOTE:** Syllabi for all courses should be available upon request. Each syllabus should show that all work for credit is college level and of the appropriate rigor. Syllabi generally include a course description, prerequisites and corequisites, the number of lecture and/or other contact hours per week, credits allocated (consistent with SUNY policy on credit/contact hours), general course requirements, and expected student learning outcomes.*

See Appendix 3: New Course Syllabi.

d) *If the program requires external instruction, such as clinical or field experience, agency placement, an internship, fieldwork, or cooperative education, **append** a completed External Instruction form at the end of this document.*

Not applicable.

NOTE: The University Faculty Senate's *Internships and Co-ops, A Guide for Planning, Implementation and Assessment* is a helpful reference: http://www.system.suny.edu/media/suny/content-assets/documents/faculty-senate/Internship-Guide--update-10.19.16.pdf

SUNY Undergraduate Program Schedule

Program/Track Title and Award: Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations

- Indicate **academic calendar type**: [X] Semester [ ] Quarter [ ] Trimester [ ] Other (describe):
- **Name of SUNY Transfer Path: Physics** **See Transfer Path Requirement Summary for details**

General Physics Concentration:

Term 1: Fall 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2240 General Physics 1	3	NS	3	3	3		MA2310 (co)
CP2241 General Physics 1 Lab	1	NS	1	1	1		CP2240 (co)
MA2310 Calculus I	4	M	4	4	4		MA2090
EL1000 English Composition I	4	BC	4				
FY1000 Ethics of Engagement	4	D	4				
Term credit totals:	16	16	16	8	8		

Term 2: Spring 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2250 General Physics 2	3		3	3	3		CP2240
CP2251 General Physics 2 Lab	1		1	1	1		CP2250 (co)
MA2320 Calculus II	4		4	4	4		MA2310
EL22XX English Composition II	4		4				EL1000
CL2000 Community Learning	2		2				
Term credit totals:	14	0	14	8	8		

Term 3: Fall 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2260 General Physics 3	3		3	3	3		CP2250
CP2261 General Physics 3 Lab	1		1	1			CP2260 (co)
MA3330 Calculus III	4		4	4	4		MA2320
CP2120 Principles of Chemistry I	3		3	3	3		MA1020
CP2121 Principles of Chemistry I Lab	1		1	1	1		CP2120 (co)
Elective	3						
Term credit totals:	15	0	12	12	11		

Term 4: Spring 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3600 Mechanics	3		3	3		x	CP2260, MA2320
CP3800 Relativity	3		3	3		x	CP2260, MA2320
CP2130 Principles of Chemistry II	3		3	3	3		CP2120
CP2131 Principles of Chemistry II Lab	1		1	1	1		CP2121, CP2130 (co)
Elective	3						
Elective	3						
Term credit totals:	16	0	10	10	4		

Term 5: Fall 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3230 Math Methods in Phys. Sci.	3		3	3	3		MA2320
MA3160 Linear Algebra	4		4	4			MA2310
GE: Creativity and the Arts	4	AR	4				
GE: Western Tradition	4	WC	4				
Term credit totals:	15	8	15	7	3		

Term 6: Spring 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3700 Electromagnetism	3		3	3		x	CP2260, MA3330
CP3900 Experimental Physics	3		3	3		x	CP3700 (co)
MA4360 Differential Equations	4		4	4			MA2320, MA3160
GE: American Experience	4	AH	4				
Term credit totals:	14	4	14	10	0		

Term 7: Fall 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4100 Thermodynamics	3		3	3		x	CP2260, MA2320
CP5920 Seminar 1	1		1	1			
CP5900 Research	3		3	3			
GE: Major Cultures	4	OW	4				
GE: Foreign Language	4	FL	4				
Term credit totals:	15	8	15	7	0		

Term 8: Spring 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4200 Quantum Mechanics	3		3	3		x	CP2260, MA2320
CP4600 Applied Mechanics	3		3	3		x	CP2260, MA2320
CP5921 Seminar 2	1		1	1			
GE: Humanities	4	H	4				
GE: Social Sciences (upper div.)	4	SS	4				
Term credit totals:	15	8	15	7	0		

Program Totals (in credits):	**Total Credits:120**	**SUNY GER: 44**	**LAS: 111**	**Major: 69**	**Elective & Other: 9**	**Upper Division: 45**	**Upper Division Major: 41**	**Number of SUNY GER Categories: 11**

KEY Cr: credits GER: SUNY General Education Requirement LAS: Liberal Arts & Sciences Maj: Major requirement (Enter credits) TPath: SUNY Transfer Path Courses (Enter credits) New: new course (Enter X) Co/Prerequisite(s): list co/prerequisite(s) for the noted courses Upper Division: Courses intended primarily for juniors and seniors SUNY GER Category Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC), plus college Diversity requirement (D)

Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC)

Health Science Concentration:

Term 1: Fall 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2240 General Physics 1	3	NS	3	3	3		MA2310 (co)
CP2241 General Physics 1 Lab	1	NS	1	1	1		CP2240 (co)
MA2310 Calculus I	4	M	4	4	4		MA2090
EL1000 English Composition I	4	BC	4				
FY1000 Ethics of Engagement	4	D	4				
Term credit totals:	16	16	16	8	8		

Term 2: Spring 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2250 General Physics 2	3		3	3	3		CP2240
CP2251 General Physics 2 Lab	1		1	1	1		CP2250 (co)
MA2320 Calculus II	4		4	4	4		MA2310
EL22XX English Composition II	4		4				EL1000
CL2000 Community Learning	2		2				
Term credit totals:	14	0	14	8	8		

Term 3: Fall 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2260 General Physics 3	3		3	3	3		CP2250
CP2261 General Physics 3 Lab	1		1	1			CP2260 (co)
MA3330 Calculus III	4		4	4	4		MA2320
CP2120 Principles of Chemistry I	3		3	3	3		MA1020
CP2121 Principles of Chemistry I	1		1	1	1		CP2120 (co)
GE: Creativity and the Arts	4	AR	4				
Term credit totals:	16	4	16	12	11		

Term 4: Spring 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3600 Mechanics	3		3	3		x	CP2260, MA2320
CP3800 Relativity	3		3	3		x	CP2260, MA2320
CP2130 Principles of Chemistry II	3		3	3	3		CP2120
CP2131 Principles of Chemistry II Lab	1		1	1	1		CP2121, CP2130 (co)
GE: Western Tradition	4	WC	4				
Term credit totals:	14	4	14	10	4		

Term 5: Fall 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3230 Math Methods in Phys.	3		3	3	3		MA2320
CP3300 Organic Chemistry 1	3		3	3			CP2130
CP3302 Organic Chemistry 1 Lab	2		2	2			CP3300 (co)
BS2400 Basic Biology I	3		3	3			
BS2401 Basic Biology I Lab	1		1	1			BS2400 (co)
Elective (upper div.)	2						
Term credit totals:	14	0	12	12	3		

Term 6: Spring 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3700 Electromagnetism	3		3	3		x	CP2260, MA3330
CP3900 Experimental Physics	3		3	3		x	CP3700 (co)
CP3310 Organic Chemistry 2	3		3	3			CP3300
CP3312 Organic Chemistry 2 Lab	2		2	2			CP3310 (co)
BS2410 Basic Biology II	3		3	3			BS2400
BS2411 Basic Biology II Lab	1		1	1			BS2410 (co)
Term credit totals:	15	0	15	15	0		

Term 7: Fall 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4100 Thermodynamics	3		3	3		x	CP2260, MA2320
CP 4490 Biochemistry for Life	3		3	3			CP3310
CP5920 Seminar 1	1		1	1			
GE: American Experience	4	AH	4				
GE: Major Cultures	4	OW	4				
Term credit totals:	15	8	15	7	0		

Term 8: Spring 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4200 Quantum Mechanics	3		3	3		x	CP2260, MA2320
CP5921 Seminar 2	1		1	1			
GE: Foreign Language	4	FL	4				
GE: Humanities	4	H	4				
GE: Social Sciences (upper div.)	4	SS	4				
Term credit totals:	16	12	16	4	0		

Program Totals (in credits):	**Total Credits:120**	**SUNY GER: 44**	**LAS: 118**	**Major: 76**	**Elective & Other: 2**	**Upper Division: 46**	**Upper Division Major: 40**	**Number of SUNY GER Categories: 11**

KEY Cr: credits GER: SUNY General Education Requirement LAS: Liberal Arts & Sciences Maj: Major requirement (Enter credits) TPath: SUNY Transfer Path Courses (Enter credits) New: new course (Enter X) Co/Prerequisite(s): list co/prerequisite(s) for the noted courses Upper Division: Courses intended primarily for juniors and seniors SUNY GER Category Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC), plus college Diversity requirement (D)

Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC)

Quantitative Finance Concentration:

Term 1: Fall 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2240 General Physics 1	3	NS	3	3	3		MA2310 (co)
CP2241 General Physics 1 Lab	1	NS	1	1	1		CP2240 (co)
MA2310 Calculus I	4	M	4	4	4		MA2090
EL1000 English Composition I	4	BC	4				
FY1000 Ethics of Engagement	4	D	4				
Term credit totals:	16	16	16	8	8		

Term 2: Spring 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2250 General Physics 2	3		3	3	3		CP2240
CP2251 General Physics 2 Lab	1		1	1	1		CP2250 (co)
MA2320 Calculus II	4		4	4	4		MA2310
EL22XX English Composition II	4		4				EL1000
CL2000 Community Learning	2		2				
Term credit totals:	14	0	14	8	8		

Term 3: Fall 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2260 General Physics 3	3		3	3	3		CP2250
CP2261 General Physics 3 Lab	1		1	1	1		CP2260 (co)
MA3330 Calculus III	4		4	4	4		MA2320
CS2510 Computer Programming I	4		4	4	4		MA1020
GE: Creativity and the Arts	4	AR	4				
Term credit totals:	16	4	16	12	12		

Term 4: Spring 2	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3600 Mechanics	3		3	3		x	CP2260, MA2320
CP3800 Relativity	3		3	3		x	CP2260, MA2320
MA2000 Applied Statistics	4		4	4			MA1010
GE: Western Tradition	4	WT	4				
Term credit totals:	14	4	14	10	0		

Term 5: Fall 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3230 Math Methods in Phys. Sci.	3		3	3	3		MA2320
MA3160 Linear Algebra	4		4	4			MA2310
GE: American Experience	4	AH	4				
GE: Major Cultures	4	OW	4				
Term credit totals:	15	8	15	7	3		

Term 6: Spring 3	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3700 Electromagnetism	3		3	3		x	CP2260, MA3330
CP3900 Experimental Physics	3		3	3		x	CP3700 (co)
MA4360 Differential Equations	4		4	4			MA2320, MA3160
BU4762 Financial Management I	4			4			BU 3502, MA 2000
Term credit totals:	14	0	10	14	0		

Term 7: Fall 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4100 Thermodynamics	3		3	3		x	CP2260, MA2320
BU5740 Investment Management and Security Analysis	4			4			BU4762
CP5920 Seminar 1	1		1	1			
GE: Foreign Language	4	FL	4				
GE: Humanities	4	H	4				
Term credit totals:	16	8	12	8	0		

Term 8: Spring 4	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4200 Quantum Mechanics	3		3	3		x	CP2260, MA2320
CP4900 Econophysics	4		4	4		x	BU4762, CS2510
CP5921 Seminar 2	1		1	1			
BU5789 Futures and Options	4			4			BU4762
GE: Social Sciences	4	SS	4				
Term credit totals:	16	4	12	12	0		

Program Totals (in credits):	**Total Credits:121**	**SUNY GER: 44**	**LAS: 109**	**Major: 79**	**Elective & Other: 0**	**Upper Division: 51**	**Upper Division Major: 51**	**Number of SUNY GER Categories: 11**

KEY Cr: credits GER: SUNY General Education Requirement LAS: Liberal Arts & Sciences Maj: Major requirement (Enter credits) TPath: SUNY Transfer Path Courses (Enter credits) New: new course (Enter X) Co/Prerequisite(s): list co/prerequisite(s) for the noted courses Upper Division: Courses intended primarily for juniors and seniors SUNY GER Category Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC), plus college Diversity requirement (D)

Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC)

Applied/Computational Concentration:

Term 1: Fall 1	See KEY.							Term 2: Spring 1	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2240 General Physics 1	3	NS	3	3	3		MA2310 (co)	CP2250 General Physics 2	3		3	3	3		CP2240
CP2241 General Physics 1 Lab	1	NS	1	1	1		CP2240 (co)	CP2251 General Physics 2 Lab	1		1	1	1		CP2250 (co)
MA2310 Calculus I	4	M	4	4	4		MA2090	MA2320 Calculus II	4		4	4	4		MA2310
EL1000 English Composition I	4	BC	4					EL22XX English Composition II	4		4				EL1000
FY1000 Ethics of Engagement	4	D	4					CL2000 Community Learning	2		2				
Term credit totals:	16	16	16	8	8			Term credit totals:	14	0	14	8	8		
Term 3: Fall 2	See KEY.							**Term 4: Spring 2**	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP2260 General Physics 3	3		3	3	3		CP2250	CP3600 Mechanics	3		3	3		x	CP2260, MA2320
CP2261 General Physics 3 Lab	1		1	1			CP2260 (co)	CP3800 Relativity	3		3	3		x	CP2260, MA2320
MA3330 Calculus III	4		4	4	4		MA2320	CP2130 Principles of Chemistry II	3		3	3	3		CP2120
CP2120 Principles of Chemistry I	3		3	3	3		MA1020	CP2131 Principles of Chemistry II Lab	1		1	1	1		CP2121, CP2130(co)
CP2121 Principles of Chemistry I Lab	1		1	1	1		CP2120 (co)	CS2511 Computer Programming II	4		4	4			CS2510
CS2510 Computer Programming I	4		4	4			MA1020								
Term credit totals:	16	0	16	16	11			Term credit totals:	14	0	14	14	4		
Term 5: Fall 3	See KEY.							**Term 6: Spring 3**	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP3230 Math Methods in Phys. Sci.	3		3	3	3		MA2320	CP3700 Electromagnetism	3		3	3		x	CP2260, MA3330
CP4600 Applied Mechanics	3		3	3		x	CP2260, MA2320	CP3900 Experimental Physics	3		3	3		x	CP3700 (co)
GE: Creativity and the Arts	4	AR	4					GE: American Experience	4	AH	4				
GE: Western Tradition	4	WC	4					Elective (upper div.)	4						
Term credit totals:	15	8	15	7	4			Term credit totals:	14	4	10	6	0		
Term 7: Fall 4	See KEY.							**Term 8: Spring 4**	See KEY.						
Course Number & Title	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Cr**	**GER**	**LAS**	**Maj**	**TPath**	**New**	**Co/Prerequisites**
CP4100 Thermodynamics	3		3	3		x	CP2260, MA2320	CP4200 Quantum Mechanics	3		3	3		x	CP2260, MA2320
CP5920 Seminar 1	1		1	1				CS3810 Data Structures & Algorithms	4		4	4			CS2511, MA3030
MA3030 Discrete Math	4		4	4			MA2090	CP5921 Seminar 2	1		1	1			
GE: Major Cultures	4	OW	4					GE: Humanities	4	H	4				
GE: Foreign Language	4	FL	4					GE: Social Sciences (upper div.)	4	SS	4				
Term credit totals:	16	8	16	8	0			Term credit totals:	16	8	16	8	0		

Program Totals (in credits):	**Total Credits:120**	**SUNY GER: 44**	**LAS: 116**	**Major: 74**	**Elective & Other: 4**	**Upper Division: 46**	**Upper Division Major: 38**	**Number of SUNY GER Categories: 11**

KEY Cr: credits GER: SUNY General Education Requirement LAS: Liberal Arts & Sciences Maj: Major requirement (Enter credits) TPath: SUNY Transfer Path Courses (Enter credits) New: new course (Enter X) Co/Prerequisite(s): list co/prerequisite(s) for the noted courses Upper Division: Courses intended primarily for juniors and seniors SUNY GER Category Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC), plus college Diversity requirement (D)

Abbreviations: American History (AH), Basic Communication (BC), Foreign Language (FL), Humanities (H), Math (M), Natural Sciences (NS), Other World Civilizations (OW), Social Science (SS), The Arts (AR), Western Civilization (WC)

Section 4. Faculty

a) *Complete the **SUNY Faculty Table** on the next page to describe current faculty and to-be-hired (TBH) faculty.*

b) ***Append** at the end of this document position descriptions or announcements for each to-be-hired faculty member.*

See Appendix 4: To-Be-Hired Faculty Description

***NOTE:** CVs for all faculty should be available upon request. Faculty CVs should include rank and employment status, educational and employment background, professional affiliations and activities, important awards and recognition, publications (noting refereed journal articles), and brief descriptions of research and other externally funded projects. New York State's requirements for faculty qualifications are in Regulation 52.2 http://www.highered.nysed.gov/ocue/lrp/rules.htm.*

c) *What is the institution's definition of "full-time" faculty?*

Full-time tenured/tenure-track faculty carry a teaching load of three courses per semester and have service and scholarship obligations.

SUNY Faculty Table

Provide information on current and prospective faculty members (identifying those at off-campus locations) who will be expected to teach any course in the major. Expand the table as needed. Use a separate Faculty Table for each institution if the program is a multi-institution program.

(a)	(b)	(c)	(d)	(e)	(f)
Faculty Member Name and Title/Rank (Include and identify Program Director with an asterisk.)	**% of Time Dedicated to This Program**	**Program Courses Which May Be Taught (Number and Title)**	**Highest and Other Applicable Earned Degrees (include College or University)**	**Discipline(s) of Highest and Other Applicable Earned**	**Additional Qualifications: List related certifications, licenses, and professional experience in field.**
PART 1. Full-Time Faculty					
Michael Colaneri, Associate Professor	67%	CP2240/CP2241 General Physics 1 Lec/Lab, CP2250/CP2251 General Physics 2 Lec/Lab	PhD SUNY Buffalo	Biophysics	
John Estes, Assistant Professor	100%	CP2260/CP2261 General Physics 3 Lec/Lab, CP3700 Electromagnetism, CP3900 Experimental Physics Lab, CP 5100 Advanced Topics, CP 5910/5920 Seminar	PhD UCLA	Physics	Postdoctoral Research: Ecole Polytechnique / Ecole Normale Superieure, KU Leuven, Imperial College
Michael Kavic, Associate Professor	100%	CP2240/CP2241 General Physics 1 Lec/Lab, CP2250/CP2251 General Physics 2 Lec/Lab, CP 5100 Advanced Topics, CP4900 Econophysics, CP 5910/5920 Seminar	PhD Virginia Tech	Physics	
Matthew Lippert, Assistant Professor	100%	CP3230 Math Methods, CP3600 Mechanics, CP4600 Applied Mechanics, CP3800 Relativity, CP 5100 Advanced Topics, CP 5910/5920 Seminar	PhD UC Santa Barbara	Physics	Postdoctoral Research: U. Kentucky, Technion, U. Crete, U. Amsterdam
Camille Jones, Visiting Assistant Professor	100%	CP2120/CP2121 Principles of Chem I Lec/Lab, CP2130/CP2131 Principles of Chem II Lec/Lab, CP 4100 Thermodynamics, CP 4200 Quantum Mechanics	PhD University of Toledo	Physical Chemistry	
Lori Zaikowski, Professor, Chair Chemistry & Physics Dept.	67%	CP2120/CP2121 Principles of Chem I Lec/Lab, CP2130/CP2131 Principles of Chem II Lec/Lab	PhD, SUNY Stony Brook	Chemistry	
Bright Emenike, Associate Professor	67%	CP 3300/CP 3302 Organic Chemistry I Lec/Lab, CP 3310/CP 3312 Organic Chemistry II Lec/Lab	PhD, Miami University	Chemistry	Postdoctoral Research: Cal Tech
Youngjoo Kim, Assistant Professor	33%	CP4510 Biochemistry I, CP4490 Biochemistry for Life Sciences	PhD, Oregon Health & Science University	Chemistry	Postdoctoral Research: Yale University
Geta Techanie, Associate Professor	50%	MA2310 Calculus I, MA2320 Calculus II, MA3160 Linear Algebra	PhD, University of North Carolina Charlotte	Mathematics	
David Ralson, Associate Professor	67%	MA2310 Calculus I, MA2320 Calculus II, MA3330 Calculus III, MA4360 Differential Equations	PhD, Rice University	Mathematics	

Yogesh More, Associate Professor	50%	MA2000 Applied Statistics, MA3030 Discrete Math, MA3160 Linear Algebra	PhD, University of Michigan	Mathematics	Postdoctoral Fellow, University of Missouri-Columbia
Nicholas Werner, Assistant Professor	50%	MA2310 Calculus I, MA2320 Calculus II, MA3030 Discrete Math	PhD, Ohio State University	Mathematics	
Myong-Hi Kim, Associate Professor	67%	MA2310 Calculus I, MA2320 Calculus II, MA3030 Discrete Math, MA3160 Linear Algebra	PhD, City University of New York	Mathematics	
Jennie D'Ambroise, Associate Professor	67%	MA2310 Calculus I, MA2320 Calculus II, MA3330 Calculus III, MA4360 Differential Equations	PhD, University of Massachusetts Amherst	Mathematics	
Shebuti Rayana, Assistant Professor	33%	CS2510 Computer Programming I, CS3810 Data Structures and Algorithms	PhD, SUNY Stony Brook	Computer Science	
Renu Beyland, Assistant Professor	17%	CS2511 Computer Programming II	PhD, India Institute of Technology	Computer Science	
Ashok Basawapatna, Assistant Professor	33%	CS2510 Computer Programming I, CS3810 Data Structures and Algorithms	PhD, University of Colorado at Boulder	Computer Science	Postdoctoral Researcher, University of Northwestern Switzerland.
Tejas Bouklas, Assistant Professor	67%	BS2400/BS2401 Basic Biology I Lec/Lab	PhD, Albert Einstein College of Medicine	Biomedical Sciences Microbiology	Postdoctoral Associate, Stony Brook University
William Gillis, Assistant Professor	67%	BS2410/BS2411 Basic Biology II Lec/Lab	PhD, University of Oregon	Molecular Biology	IRACDA Postdoctoral Fellow, Stony Brook University
Albert Murphy, Professor, Chair Dept. of Management, Marketing, and Finance	33%	BU 4762 Financial Management I, BU 5740 Investment Management and Security Analysis	Ph.D., City University of New York	Business	
Zhihong Shi, Associate Professor	33%	BU 4762 Financial Management I, BU 5789 Futures and Options Markets	Ph.D., City University of New York	Business	
Part 2. Part-Time Faculty					
Part 3. Faculty To-Be-Hired (List as TBH1, TBH2, etc., and provide title/rank and expected hiring date.)					
TBH1, Assistant Professor (Starting year 4)			Ph.D.	Physics	Assuming enrollment targets are met, an additional faculty will be needed to staff the upper division courses.

Section 5. Financial Resources and Instructional Facilities

a) *What is the resource plan for ensuring the success of the proposed program over time? Summarize the instructional facilities and equipment committed to ensure the success of the program. Please explain new and/or reallocated resources over the first five years for operations, including faculty and other personnel, the library, equipment, laboratories, and supplies. Also include resources for capital projects and other expenses.*

The Chemistry and Physics department currently has four full-time tenured or tenure track physics faculty members, who will continue to teach three courses per semester, provide academic advising, and mentor student research. Four new upper division courses (Mechanics, Electromagnetism, Relativity, and Experimental Physics and Electronics Lab) will be taught every other year, beginning in year 2. Starting in year 3, one additional advanced course (Econophysics, Applied Mechanics, or other advanced topics course) will be offered per year. The additional course load will be initially covered by having adjunct faculty teach some of the lower division and service courses. As enrollment grows, another tenure-track faculty member is anticipated to be added in year 4 to cover the increased course load and provide additional advising and research mentoring.

Existing laboratory infrastructure serves the needs of the introductory sequence courses (General Physics 1-3). Additional equipment will be needed in year 3 when the upper division lab (Experimental Physics and Electronics) is introduced. If enrollment targets are met an additional purchase of new equipment will be required in year 5. After the initial purchase of new equipment in year 3 and, if necessary, year 5, there will be modest ongoing maintenance and supply costs every other year, when the course is taught. Continued growth in enrollment in the physical and life sciences will eventually necessitate an additional lab technician. Current staff are trained in chemistry and biology, a lab technician with physics expertise should be hired to complement current staff expertise.

b) *Complete the five-year SUNY Program Expenses Table, below, consistent with the resource plan summary. Enter the anticipated academic years in the top row of this table. List all resources that will be engaged specifically as a result of the proposed program (e.g., a new faculty position or additional library resources). If they represent a continuing cost, new resources for a given year should be included in the subsequent year(s), with adjustments for inflation or negotiated compensation. Include explanatory notes as needed.*

SUNY Program Expenses Table

	Expenses (in dollars)					
Program Expense Categories	**Before Start**	**Academic Year 1:**	**Academic Year 2:**	**Academic Year 3:**	**Academic Year 4:**	**Academic Year 5:**
(a) Personnel* (including faculty and all others)	$0	$0	$8,000	$12,000	$90,000	$90,000
(b) Library	$0	$0	$0	$0	$0	$0
(c) Equipment	$0	$0	$0	$0	$0	$0
(d) Laboratories	$0	$0	$0	$22,000	$0	$14,000
(e) Supplies	$0	$200	$200	$200	$200	$200
(f) Capital Expenses	$0	$0	$0	$0	$0	$0
(g) Other (Specify):	$0	$0	$0	$0	$0	$0
(h) Sum of Rows Above	**$0**	**$200**	**$8,200**	**$34,200**	**$90,200**	**$104,200**

(a) Adjunct faculty in years 2 and 3. A full-time faculty member to be hired in year 4.

(d) In year 3, a one-time purchase of equipment for the upper division laboratory equipment and an additional one-time purchase in year 5 if enrollment targets are met. Afterwards there is a $1000 recurring cost.

(e) Miscellaneous department supplies for recruitment, management, advising, etc.

Section 6. Library Resources

a) *Summarize the analysis of library collection resources and needs for this program by the collection librarian and program faculty. Include an assessment of existing library resources and accessibility to those resources for students enrolled in the program in all formats, including the institution's implementation of SUNY Connect, the SUNY-wide electronic library program.*

The majority of current physics research is available publicly through the preprint archive (https://arxiv.org/). For older articles, the library contains access to all major journals expected for the program, either onsite or electronically through several searchable databases, other electronic resources, or interlibrary loan. If there is an item in SUNY Connect that is not in the Old Westbury library collection, an inter-library loan request may be placed to obtain the requested item. The library's catalog is available online and most electronic resources are available from any web browser. The Director of the Library makes every effort to make new acquisitions at the request of faculty.

b) *Describe the institution's response to identified collection needs and its plan for library development.*

The library uses a patron-driven process to determine acquisitions, under which faculty and students serve as the drivers for the growth of the collection.

Section 7. External Evaluation

SUNY requires external evaluation of all proposed bachelor's degree programs and may request an evaluation for a proposed associate degree or certificate program in a new or emerging field or for other reasons.

Is an external evaluation required? [ ] No [X] Yes

If yes, list below all SUNY-approved evaluators who conducted evaluations (adding rows as needed), and ***append at the end of this document*** *each original, signed External Evaluation Report.* ***NOTE:*** *To select external evaluators, a campus sends 3-5 proposed evaluators' names, titles and CVs to the assigned SUNY Program Reviewer, expresses its preferences and requests approval.*

Evaluator #1:	**Evaluator #2:**
Name: Nathan Magee	Name: Neil Aaronson
Title: Professor of Physics	Title: Professor of Physics
Institution: The College of New Jersey	Institution: Stockton University

Section 8. Institutional Response to External Evaluator Reports

As applicable, **append** at the end of this document a single *Institutional Response* to all *External Evaluation Reports.*

Section 9. SUNY Undergraduate Transfer

The State University views as one of its highest priorities the facilitation of transfer.

a) *For a* ***proposed Associate in Arts (A.A.) or an Associate in Science (A.S.) degree,*** *demonstrate that the program's graduates will be able to transfer into at least two parallel SUNY baccalaureate programs and complete them within two additional years of full-time study, per SUNY policy, by listing the transfer institutions below and* ***appending*** *at the end of this document:*

- *two completed SUNY Transfer Course Equivalency Tables, one for each transfer institution; and*
- *a letter from the Chief Academic Officer of each transfer institution asserting acceptance*

of the completed Transfer Course Equivalency Table.

Program proposals must include two articulation agreements with parallel programs. Every effort should be made to obtain two SUNY articulation agreements for this requirement. In the event that such articulations are not possible, campuses are encouraged to work with their campus reviewer to find appropriate alternatives.

Baccalaureate Degree Institution	Baccalaureate Program SED Code and	Degree

b) *For a **proposed baccalaureate program,** document articulation with at least two parallel SUNY associate degree programs for seamless transfer, by **appending documentation of articulation**, such as SUNY Transfer Course Equivalency Tables and/or letters of support from Chief Academic Officers at associate degree institutions or their designees. **If transfer does not apply to this program, please explain why.***

Associate Degree Institution	Associate Program SED Code and Title	Degree
Nassau Community College	SED code: 01274, Math and Science	A.S.
Suffolk Community College	SED code: 01569, Math and Science	A.S.

Old Westbury allows students to transfer up to 80 credits. See Appendix 5 for Transfer Course Equivalency Tables for each program in the above table.

***NOTE:** Transfer course equivalency tables are needed, despite SUNY Transfer Paths, to ensure that all courses in an A.A. or A.S. program will be accepted for transfer. Official SED program titles and codes can be found on NYSED's Inventory of Registered Programs here.*

Section 10. Application for Distance Education

a) Does the program's design enable students to complete 50% or more of the course requirements through distance education? [**X**] No [ ] Yes. If yes, **append** a completed *SUNY Distance Education Format Proposal* at the end of this proposal to apply for the program to be registered for the distance education format.

b) Does the program's design enable students to complete 100% of the course requirements through distance education? [**X**] No [ ] Yes

Section MPA-1. Need for Master Plan Amendment and/or Degree Authorization

a) Based on guidance on Master Plan Amendments, please indicate if this proposal requires a Master Plan Amendment.
[**X**] No [ ] Yes, a completed *Master Plan Amendment Form* is **appended** at the end of this proposal.

b) Based on *SUNY Guidance on Degree Authorizations* (below), please indicate if this proposal requires degree authorization.

[**X**] No [ ] Yes, once the program is approved by the SUNY Provost, the campus will work with its Campus Reviewer to draft a resolution that the SUNY Chancellor will recommend to the SUNY Board of Trustees.

***SUNY Guidance on Degree Authorization.** Degree authorization is required when a proposed program will lead to a new degree (e.g., B.F.A., M.P.H.) at an existing level of study (i.e., associate, baccalaureate, first-professional, master's, and doctoral) in an existing disciplinary area at an institution. Disciplinary areas are defined by the New York State Taxonomy of Academic Programs. Degree authorization requires approval by the SUNY Provost, the SUNY Board of Trustees and the Board of Regents.*

List of Appended and/or Accompanying Items

a) Appended Items: If materials required in selected items in Sections 1 through 4 and Sections 9, 10 and MPA-1 of this form apply to this proposal, they should be appended as part of this document, after this page, with continued pagination. In the first column of the chart below, please number the appended items, and append them in number order.

Number	Appended Items	Reference Items
N/A	*For multi-institution programs*, a letter of approval from partner institution(s)	Section 1, Item (e)
N/A	*For programs leading to professional licensure*, a side-by-side chart showing how the program's components meet the requirements of specialized accreditation, Commissioner's Regulations for the Profession, or other applicable external standards	Section 2.3, Item (e)
N/A	*For programs leading to licensure in selected professions for which the SED Office of Professions (OP) requires a specialized form*, a completed version of that form	Section 2.3, Item (e)
N/A	*OPTIONAL: For programs leading directly to employment*, letters of support from employers, if available	Section 2, Item 2.3 (h)(2)
1	*For all programs*, a plan or curriculum map showing the courses in which the program's educational and (if appropriate) career objectives will be taught and assessed	Section 2, Item 7
2	*For all programs*, a catalog description for each existing course that is part of the proposed undergraduate major (including cognates and restricted electives)	Section 3, Item (b)
3	*For all programs with new courses in the major*, syllabi for all new courses in a proposed undergraduate major	Section 3, Item (c)
N/A	*For programs requiring external instruction*, a completed *External Instruction Form* and documentation required on that form	Section 3, Item (d)
4	*For programs that will depend on new faculty*, position descriptions or announcements for faculty to-be-hired	Section 4, Item (b)
5	*For all A.A. and A.S. programs*, Transfer Equivalency Tables and letters of support from at least two SUNY baccalaureate institutions; *for baccalaureate programs that anticipate transfer student enrollment*, documentation of seamless transfer with at least two SUNY two-year programs	Section 9
N/A	*For programs designed to enable students to complete at least 50% of the course requirements at a distance*, a *Distance Education Format Proposal*	Section 10
N/A	*For programs requiring an MPA*, a *Master Plan Amendment Form*	Section MPA-1

b) Accompanying Items - External Evaluations and Institutional Response: If Sections 7 and 8 of this form indicate that external evaluation is required as part of this proposal, please send a separate electronic document to *program.review@suny.edu* that contains the original, signed *External Evaluation Reports* and a single *Institutional Response* to all reports. The file name should indicate the campus, program title, award and content of the file (e.g., BuffaloU-English-PhD-ExEval).

Appendix 1: Curriculum Map

Legend: B: Introductory/Basic Understanding P: Practiced and Reinforced A: Assessed Course numbers and names	Understand, recall, and apply the core principles of the laws of physics including classical mechanics, electricity and magnetism, quantum mechanics, relativity, and statistical mechanics.	Apply mathematical skills, programming skills and physics concepts together to model physical systems.	Apply the process of science and the scientific method including generating theoretical principles, testing hypotheses, experimental design, and developing problem-solving strategies.	Collect, evaluate, and interpret experimental data, including having a detailed understanding of the electronics and other equipment commonly used in laboratory settings.	Communicate scientific ideas and information clearly in both written and oral formats.
CP 2240 General Physics I	B		B		
CP 2241 General Physics I Lab			P	B	B
CP 2250 General Physics II	P		P		
CP 2251 General Physics II Lab			P	P	P
MA 2310 Calculus 1		B			
MA 2320 Calculus 2		P			
CP 2120 Principles of Chemistry I*	P		P		
CP 2121 Principles of Chemistry I Lab*			P	P	P
CP 2130 Principles of Chemistry II*	P		P		
CP 2131 Principles of Chemistry II Lab*			P	P	P
CP 2260 General Physics III	P		P		
CP 2261 General Physics III Lab		P	P	P	P
CP 3230 Math Methods in the Physical Sci.		P			
MA 3330 Calculus 3		P			
CP 3600 Mechanics	P		P		
CP 3700 Electromagnetism	P	P	P		
CP 3800 Relativity	P		P		
CP 3900 Exp. Physics & Electronics Lab		P	P	A	P
CP 4100 Thermodynamics	P	A	P		
CP 4200 Quantum Mechanics	A		P		
CP 5920 Seminar 1			A		P
CP 5921 Seminar 2					A

Appendix 2: Course Descriptions

Foundational Core Requirements

CP 2240 General Physics I - 3 cr.
The first semester of a calculus-based introductory physics course primarily for chemistry and math majors. Kinematics, energy, momentum and rotational motion are included. Offered every Fall.
Prerequisite: MA2310, completed with grade of "C" or better.
**MA2310 will be changed to a co-requisite.*

CP 2241 General Physics I Lab - 1 cr.
A three-hour laboratory course illustrating topics covered in CP2240. Offered in conjunction with CP2240.
Co-requisite: CP2240.

CP 2250 General Physics II - 3 cr.
The second semester of a calculus-based general physics course. Optics, electricity, wave motion and magnetism are included. Offered every Spring.
Prerequisite: CP2240 completed with grade of "C" or better.

CP 2251 General Physics II Lab - 1 cr.
A three-hour laboratory course illustrating topics covered in CP2250. Offered in conjunction with CP2250.
Co-requisite: CP2250

CP 2260 General Physics III - 3 cr.
The third semester of a calculus-based general physics course. Thermodynamics, fluid mechanics, atomic, nuclear, and particle physics are included. Offered every Fall.
Prerequisite: CP2240

CP 2261 General Physics III Lab - 1 cr.
A three-hour laboratory course illustrating topics covered in CP2261. Offered in conjunction with CP2260.
Co-requisite: CP2250

MA 2310 Calculus & Analytic Geometry I - 4 cr.
Topics include functions and their graphs, limits and continuity, derivatives of polynomials, rational functions, algebraic functions, exponential & logarithmic functions, and trigonometric functions, applications of the derivative, definite and indefinite integrals, fundamental theorem of calculus. Offered every semester.
Prerequisite: grade of "C" or higher in MA2090.

MA 2320 Calculus & Analytic Geometry II - 4 cr.
Topics include indefinite and definite integral, applications of definite integral, integration techniques, infinite series, and analytic geometry. Offered every semester.
Prerequisite: grade of "C" or higher in MA2310.

CP 2120 Principles of Chemistry I - 3 cr.
Introduction to the origins and principles of modern chemistry. Discussion of atomic and molecular structure, stoichiometry, periodicity, bonding and states of matter. Principles are illustrated through demonstrations and study of descriptive chemistry. Offered every semester.
Prerequisite: MA1020, completed with grade "C" or better.

CP 2121 Principles of Chemistry I Lab - 1 cr.
Laboratory course designed to illustrate concepts of Principles of Chemistry I. Emphasis on basic chemical concepts, quantitative laboratory skills, descriptive chemistry, and development of scientific report writing skills. Three laboratory hours per week. Offered in conjunction with CP2120.

Co-requisite: CP2120.

CP 2130 Principles of Chemistry II - 3 cr.
Continuation of Principles of Chemistry I. Discussion of acid/base and oxidation/reduction reactions, equilibrium, kinetics and electrochemistry. Principles are illustrated through demonstrations and study of descriptive chemistry. Offered every semester.
Prerequisite: CP2120 completed with grade of "C" or better.

CP 2131 Principles of Chemistry II Lab - 1 cr.
Continuation of CP2121. Emphasis on basic chemical concepts, quantitative laboratory skills, descriptive chemistry, and development of scientific report writing skills. Three laboratory hours per week. Offered in conjunction with CP2130.
Prerequisite: CP2121 completed with grade of "C" or better; Co-requisite: CP2130.

Upper Division Core Requirements

CP 3230 Math Methods in the Physical Sciences - 3 cr.
Application of advanced mathematical principles to problems in the physical sciences. Topics include infinite and power series, functions of several variables, matrix and vector algebra, Fourier analysis, special functions and differential equations. Offered periodically.
Prerequisite: MA2320.

CP 5920 Seminar I - 1 cr.
Capstone course in which the student integrates coursework in the sub-disciplines to discuss topics of current interest in the profession. Includes instruction in library resources and on-line searching, scientific writing, ethics workshops and oral presentations. Students choose a supervisor and seminar topic and submit a draft written report. Attendance at Science Seminar Series is required. Offered every Fall.
Prerequisite: Senior Standing or Permission of the Instructor.

CP 5921 Seminar II - 1 cr.
Continuation of CP5920. Emphasis on producing paper in American Chemical Society format. Attendance at Science Seminar Series is required. Offered every Spring.
Prerequisite: CP5920

MA 3330 Calculus & Analytic Geometry III - 4 cr.
Three main areas will be studied. The first is the Vector algebra and geometry of three-dimensional space including: lines, planes, and curves in space; polar, cylindrical, and spherical coordinate systems. Using this geometry, limits, partial differentiation, directional derivatives, max-min theory and Lagrange Multipliers are studied. The final area of study is integration, including double, triple integrals, line integrals, and the divergence, Green's and Stokes Theorems. Offered in Fall semester.
Prerequisite: grade of "C" or higher in MA2320.

Concentration Requirements

MA 3160 Linear Algebra - 4 cr.
An introduction to linear algebra. Topics included systems of linear equations, matrices and matrix algebra, determinants and their properties, vectors and vector spaces, linear independence, span of a set of vectors, basis and dimension of a vector space, linear transformations of vector spaces, rank of a matrix and the rank theorem, eigenvalues and eigenvectors, and diagonalization of matrices.
Prerequisite: grade of "C" or higher in MA2310 or MA2300

MA 4360 Differential Equations - 4 cr.

A study of differential equations and their applications; ordinary differential equations with particular emphasis on linear differential equations, systems of differential equations, boundary value problems and applications to electrical, mechanical and chemical systems. Offered every spring.
Prerequisites: grades of "C" or higher in MA2320 and MA3160.

CP 5900 Research - 2-4 cr.
Research project carried out under the supervision of a faculty member. Each project includes a survey of the appropriate original literature, a theoretical or experimental investigation, and a comprehensive report of the results. Open only to students accepted as research trainees sponsored by a member of the Chemistry and Phys- ics faculty. Offered every semester. Grading will be CR/NC.
Prerequisite: Permission of the Chemistry/Physics faculty.

BS 2400-BS2401 Basic Biology I - 4 cr.
Lecture/Laboratory first semester of freshman biology courses covering content areas including molecular and cellular biology, genetics, genomics and evolution. These courses are offered every semester.
Prerequisites: ECII; MA1020; students must register for lecture, BS2400 and lab, BS2401 if taken for the first time

BS 2410-BS 2411 Basic Biology II - 4 cr.
Lecture/Laboratory second semester of freshman biology courses covering content areas including cell metabolism, comparative animal and plant anatomy and physiology and ecology. These courses are offered every semester.
Prerequisites: BS2400/BS2401 with grades of "C" or better; students must register for lecture, BS2410 and lab, BS2411 if taken for the first time.

CP 3300 Organic Chemistry I - 3 cr.
The first semester of an introductory organic chemistry course. Discussion of major classes of organic compounds, with emphasis on structure, reactions, synthesis, stereochemistry and reaction mechanism. Offered every Fall.
Prerequisite: CP2130 completed with grade of "C" or better.

CP 3302 Organic Chemistry I Lab - 2 cr.
Designed to illustrate topics of CP3300. Stresses development of laboratory skills in synthesis, separation and purification of organic compounds. Emphasizes scientific report writing skills. Four laboratory hours per week. Offered in conjunction with CP3300.
Prerequisites: CP2130 and CP2131 with grades of "C" or better; Co-requisite: CP3300.

CP 3310 Organic Chemistry II - 3 cr.
Continuation of Organic Chemistry I, with discussion of additional major classes of organic compounds. Offered every Spring.
Prerequisite: CP3300.

CP 3312 Organic Chemistry II Lab - 2 cr.
Designed to illustrate topics of CP3310. Stresses additional synthetic techniques not covered in CP3302, spectro- scopic methods and qualitative organic analysis. Emphasizes scientific report writing skills. Four laboratory hours per week. Offered in conjunction with CP3310.
Prerequisite: CP3302; Co-requisite: CP3310.

CP 4510 Biochemistry I - 3 cr.
Comprehensive coverage of the chemistry and metabolism of biological compounds, including proteins, nucleic acids, lipids, polysaccharides, and their precursors. Also treats enzyme kinetics, bioenergetics and bio- synthesis of important biomolecules. Offered every Fall.
Prerequisite: CP3310 with a grade of C or better.

CP 4490 Biochemistry for Life Sciences - 3 cr.

One semester survey course designed for life science majors requiring only one semester of biochemistry. We will cover basic concepts about pH, biological buffers, bioenergetics, nucleotides, amino acids, proteins, enzymes, carbohydrates, lipids, intermediary metabolism, and molecular biology. This course is not open to Biochemistry majors for credit.
Prerequisites: CP 3310 with a grade of C or better.

MA 2000 Applied Statistics - 4 cr.
Applied Statistics is a Liberal Education Curriculum course intended to develop the statistical literacy of all students regardless of their major. The emphasis is on organizing and summarizing data, applying appropriate statistics, and on understanding and interpreting the results of statistical tests. Real data derived from a variety of fields including education, psychology, sociology, life and physical sciences, economics, and business will be used throughout the course.
Prerequisite: grade of "C" or higher in MA1010.

MA 3030 Discrete Math - 4 cr.
An introduction to discrete mathematical structures. Topics include propositional and predicate logic, set theory, relations and functions, induction and recursion, methods of proof, number theory, and graphs and trees. Offered every semester.
Prerequisite: grade of "C" or higher in MA2090 or MA2080

CS 2510 Computer Programming I - 4 cr.
An introduction to problem solving through programming. Topics include program design and analysis: algorithmic processes, fundamental techniques of program development, debugging and testing. Programming projects and applications will be written in a structured computer language. Students learn the basic language features of C++/Java to write basic to intermediate level programs. Offered every semester.
Prerequisite: MA1020

CS 2511 Computer Programming II - 4 cr.
Continuation of CS 2510. Discussion of methods, arrays, class and object, inheritance, polymorphism, exceptions, file operations, and GUI (Graphical User Interface) applications. Basic data structures and algorithms like insertion sort, binary search in a sorted array, and recursion may also be discussed if time allows. Students write intermediate to advanced level programs in C++/Java. Offered every semester.
Prerequisite: CS2510.

CS 3810 Data Structure & Algorithms - 4 cr.
Introduces abstract data structures and their implementations, including lists, stacks, queues, trees, hash tables, heaps and linked structures. Analyze and design sorting and searching algorithms. Learn computational evaluation on performance of algorithms. Advanced level programming. Assignments conforming to Object-Oriented methodology covered in CS2511. Offered every semester.
Prerequisite: CS2511 and MA3030.

BU 4762 Financial Management I - 4 cr.
This course provides an introduction to the basic ideas of finance. The primary concepts covered include introductory accounting knowledge, time value of money, risk-return trade-off, the basic characteristics of financial markets and financial securities, cost of capital budgeting. Offered every semester.
Prerequisites: BU3502, MA2000.

BU 5740 Investment Management and Security Analysis - 4cr.
Study of theories, techniques and approaches for determining the values of major types of securities including derivation of capitalization rates, forecasting of earnings and technical analysis. Evaluation of the dividend, capital leverage controversies and the efficient market hypothesis. Introduction to modern portfolio theories and investment strategies. Offered every semester.
Prerequisite: BU4762.

BU 5789 Futures and Options Markets - 4 cr.
This class will provide students with a basic knowledge of derivatives in options, futures, and forwards markets. Topics include option valuation models, principles of forward and futures pricing, structure of markets for derivative securities, and strategies for hedging and speculation. Offered every year.
Prerequisite: BU4762

Appendix 3: Syllabi for new courses

- CP 3600 Mechanics
- CP 3700 Electromagnetism
- CP 3800 Relativity
- CP 3900 Experimental Physics & Electronics Lab
- CP 4100 Thermodynamics
- CP 4200 Quantum Mechanics
- CP 4600 Applied Mechanics
- CP 4900 Econophysics

CP 3600 - Mechanics
Spring

Course Description: This course will cover the basic ideas and techniques of analytical mechanics, in particular the calculus of variations, Hamilton's Principle, and Lagrangian Dynamics. Topics will include conservation laws, oscillations and waves, gravity and central force motion, and chaos.

Learning Outcomes:

- Acquire a deep understanding of the advanced principles of classical mechanics.
- Apply mathematical and programming skills and concepts to model physical systems and solve problems.

Classes: Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Credits: 3

Prerequisites: CP 2260, MA 2320

Textbooks:

- *Classical Dynamics of Particles and Systems*, Thornton and Marion, 5th ed., Brooks Cole 2003
- *The Theoretical Minimum*, Susskind and Hrabovsky, Basic Books, 2014

Assessments

Exams: There will be three exams: two in-class exams and a final exam during exam week. Make-ups for exams will be given ***only*** by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework: Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Grading: Grades will be assigned at the end of the semester according to the following weights:

- Homework 40%
- Exam 1 15%
- Exam 2 15%
- Final exam 30%

Grade of Incomplete:

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Withdrawal:

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Blackboard and E-mail:

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Course Schedule:

Week	Class Topic	Chapter	Assignments
1	Introduction	SH L1	
2	Coordinates and vectors	MT 1	
3	Newtonian Mechanics	MT 2, SH 2-3	P.S. 1
4			P.S. 2
5	Energy	MT2, SH 5	P.S. 3
6			P.S. 4
7	Oscillations	MT 3	P.S.5, Exam 1
8			P.S. 6
9	Nonlinear Oscillations and Chaos	MT 4	P.S. 7
10			P.S. 8
11	Lagrangian Dynamics	MT 6, SH 6	P.S. 9, Exam 2
12			
13			P.S. 10
14	Hamiltonian Dynamics	MT 7	P.S. 11
15	Central Force Motion	MT 8	P.S. 12
16	Finals Week		Final exam

Syllabus Author: Prof. Matthew Lippert

CP 3700 - Electricity and Magnetism

Spring

Course Description:

Physics CP 3700 is an upper division course covering the topic of electrostatics and magnetostatics. The topics covered include electrostatics; special techniques for differential equations; electric fields in matter; magnetostatics and magnetic fields in matter and Maxwell's equations.

Credits: 3

Prerequisites: CP 2260, MA 3330

Learning Outcomes:

- Students will understand and be able to recall and apply the core principles of electromagnetism.
- Students will understand and be able apply mathematical skills and physical principles to model electrical and magnetic phenomena.

Classes:

Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Textbooks:

- *Griffiths: Introduction to Electrodynamics*, 4th edition, Griffths

Assessments:

Exams:

There will be two exams: a midterm in the middle of the semester and a final exam during exam week. Make-ups for exams will be given *only* by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework:

Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Grading:

Grades will be assigned at the end of the semester according to the following weights:

- Homework 40%
- Midterm 30%
- Final exam 30%

Grade of Incomplete:

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Course Schedule:

Week	Topic	Chapter
1	Vector Analysis - Derivatives	1
2	Vector Analysis - Integration	1
3	Electrostatics	2
4	Electrostatics	2
5	Potentials	3
6	Potentials	3
7	Midterm	
8	Magnetostatics	5
9	Electric and Magnetic Fields in Matter	4/6
10	Electrodynamics	7
11	Conservation Laws	8
12	Electromagnetic Waves	9
13	Potentials and Fields	10
14	Radiation	11
15	Final	

Syllabus Author: Prof. John Estes

CP 3800 - Relativity
Spring

Course Description: This course will present the concepts and principles of Einstein's theory of special relativity, as well as an introduction to general relativity. Topics will include relativistic kinematics and mechanics, Minkowski spacetime, Lorentz transformations, four-vectors, the metric, and spacetime curvature. Applications to particle physics, astrophysics, and cosmology will be covered.

Learning Outcomes:

- Acquire an understanding of the principles of special and general relativity.
- Apply mathematical skills and concepts to model physical systems and solve problems.

Classes: Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Credits: 3

Prerequisites: CP 2260, MA 2320

Textbooks:

- *Spacetime Physics: Introduction to Special Relativity*, 2nd. ed, Taylor and Wheeler, W.H. Freeman, 1992
- *Introduction to Special Relativity*, 2nd ed. Rindler, Oxford University Press, 1991

Assessments

Exams: There will be two exams: one in-class midterm exam and a take-home final exam during exam week. Make-ups for exams will be given ***only*** by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework: Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Presentation: Students will research an application of the topics of the course and give an oral presentation to the class at the end of the semester. A written abstract will be submitted, and the presentations will be conducted in class.

Grading: Grades will be assigned at the end of the semester according to the following weights:

- Homework 30%
- Midterm exam 20%
- Presentation 20%
- Final exam 30%

Grade of Incomplete:

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Course Schedule

Week	Class Topic	Chapter	Assignments
1	Introduction	TW 1	
2	Frames of Reference and Coordinates	R 1, TW 2	
3			P.S. 1
4	Relativistic Kinematics	R 2, TW 3	P.S. 2
5			P.S. 3
6	Spacetime	R 4, TW 5	P.S. 4
7			P.S.5
8	Relativistic Mechanics	R 5, TW 7,8	P.S. 6
9			P.S. 7
10			P.S. 8, **Midterm exam**
11	Metric and Curvature	TW 9	
12			P.S. 9
13	FRW Cosmology		P.S. 10
14	Black Holes		P.S. 11
15	Student Presentations		P.S. 12
16	Finals Week		**Final exam**

Syllabus Author: Prof. Matthew Lippert

CP 3900 - Experimental Physics and Electronics Lab

Spring

Course Description:

This course provides an introduction to the electronics and instrumentation used in experiments. Topics include DC and AC circuits, filters, power supplies, transistors, diodes and operational amplifiers and if time permits analog to digital converters and logic. This is primarily a lab class, but time will also be spent in and out of the class on the mathematical description of the circuits and instruments, as well as, discussions of the theory underlying modern components, such as the diode and transistor.

Credits: 3

Co-requisite: CP 3700

Learning Outcomes:

- Students will be able to design experiments from the ground up in order to test their hypotheses and explore theoretical models.
- Students will gain a fundamental understanding of the electronic equipment and instrumentation used in experiments.
- Students will be able to communicate scientific information in both written and oral formats.

Classes:

One 180-minute meeting per week. The meeting will consist of an introductory lecture lasting around an hour after which students will work on laboratory activities. The activities will include testing theoretical models and principles, exploring the behavior of circuits and instruments, and designing, creating and testing circuits/instruments for specific purposes.

Textbooks:

- *Learning the Art of Electronics A Hands-On Lab Course*, 1st ed, Thomas C. Hayes and Paul Horowitz, Cambridge University Press 2016
- *The Art of Electronics*, 3rd ed, Paul Horowitz and Winfield Hill, Cambridge University Press 2015

Assessments:

Homework:

Weekly assignments will be given and will be due the following week. The assignments will contain theoretical questions based on the lecture and lab activities. Data and analysis for the weekly lab will also be included as part of the assignment. Late assignments will not be accepted without prior approval.

Lab reports:

The course will have four lab reports structured around four different units: DC circuits, AC circuits, diodes/transistors and operational amplifiers. For a given unit, the report will contain a discussion of relevant physical principles and theoretical models. Students will select experiments from the course to demonstrate and illustrate the theoretical discussion. You do not need to include all experiments done in the class. Circuit schematics, essential data and data analysis should be included for each experiment included in your lab report. The report should be written concisely and use scientific language and arguments.

Final project:

As a final project, the student will design and perform their own experiment using the ideas and techniques learned throughout the semester.

Grading:

Grades will be assigned at the end of the semester according to the following weights:

- Homework 40%
- Lab reports 40%
- Final project 20%

Course Schedule:

Week	Lecture Topic	Lab
1	DC Circuits	Circuit notation and schematics, breadboards, and basic circuits
2	AC and complex notation	Ohm's law, voltage divider, voltmeter and ammeter
3	RC Circuits	Capacitors and RC filters
4	LC Circuits	LC resonant circuit
5	Diode Circuits	Rectifiers
6	Transistor circuits I	Transistors I
7	Transistor circuits II	Transistors II
8	Op-amps I	Op-amps I
9	Op-amps II	Op-amps II

10	Op-amps III	Op-amps III
11	Op-amps IV	Op-amps IV
12	Voltage Regulators	Voltage regulators
13	MOSFET Switches	MOSFET Switches
14	Final project	Final project
15	Final project	Final project

Grade of Incomplete:

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Withdrawal:

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Syllabus Author: Prof. John Estes

CP 4100 - Thermodynamics
(cross listed with CP 4700 - Physical Chemistry I)
Fall

Course Description: This course is an introduction to the concepts and laws of thermodynamics and their statistical basis. Topics will include temperature, heat, thermal equilibrium, reversible and irreversible processes, entropy, and free energy. Applications such as ideal gases, Einstein solids, spin systems, heat engines, refrigerators, black holes, and phase transitions will be covered.

Learning Outcomes:

- Acquire an understanding of the principles and techniques of thermodynamics and statistical mechanics.
- Apply concepts from mathematics to analytical, quantitative problems.

Classes: Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Credits: 3

Prerequisite: CP2260, MA2320

Textbook:

- *An Introduction to Thermal Physics*, Schroeder, 1st ed., Addison-Wesley, 2000

Assessments

Exams: There will be two exams: one in-class midterm exam and a take-home final exam during exam week. Make-ups for exams will be given ***only*** by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework: Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Presentation: Students will research an application of the topics of the course and give an oral presentation to the class at the end of the semester. A written abstract will be submitted, and the presentations will be conducted in class.

Grading: Grades will be assigned at the end of the semester according to the following weights:

- Homework 30%
- Midterm exam 20%
- Presentation 20%
- Final exam 30%

Grade of Incomplete:

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Course Schedule

Week	Class Topic	Chapter	Assignments
1	Introduction, temperature and thermal equilibrium	1.1	
2	Ideal gas	1.2	
3	Equipartition, Heat and work, 1st Law	1.3-1.4	P.S. 1
4	Gas compression and expansion	1.5	P.S 2
5	Heat capacity, Enthalpy	1.6	P.S. 3
6	Heat conduction, Two-state systems, Einstein solid	1.7, 2.1-2.2	P.S. 4
7	Entropy, 2nd law	2.3-2.4	P.S.5
8		2.6	**Midterm Exam**
9	Ideal gas entropy	2.5	P.S. 6
10	Temperature, 3rd law, Black hole entropy	3.1-3.4	**P.S. 7**
11	Mechanical and Diffusive Equilibrium	3.4-3.5	P.S. 8
12	Heat engines and refrigerators	4.1-4.4	P.S 9
13	Free energy	5.1-5.2	P.S. 10
14	Phase transitions	5.3-5.6	P.S. 11
15	Student Presentations		P.S. 12
16	Finals week		**Final exam**

Syllabus Author: Prof. Matthew Lippert

CP 4100 - Quantum Mechanics
(cross listed with CP 4710 - Physical Chemistry II)
Spring

Course Description: This course is an introduction to the concepts and methods of quantum mechanics. Topics will include the postulates of quantum mechanics. Schrödinger's equation, Dirac notation, measurements, operators and observables, angular momentum and spin, and the exclusion principle. Applications will include harmonic oscillator, the hydrogen atom, and scattering.

Learning Outcomes:

- Acquire an understanding of the principles and techniques of quantum mechanics.
- Apply concepts from mathematics to analytical, quantitative problems.

Classes: Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Credits: 3

Prerequisite: CP2260, MA2320

Textbook:

- *Introduction to Quantum Mechanics*, Griffiths, 3rd ed., Cambridge, 2018
- *Quantum Mechanics: The Theoretical Minimum*, Susskind and Friedman, Basic Books, 2014

Assessments

Exams: There will be two exams: one in-class midterm exam and a take-home final exam during exam week. Make-ups for exams will be given ***only*** by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework: Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Presentation: Students will research an application of the topics of the course and give an oral presentation to the class at the end of the semester. A written abstract will be submitted, and the presentations will be conducted in class.

Grading: Grades will be assigned at the end of the semester according to the following weights:

- Homework 30%
- Midterm exam 20%
- Presentation 20%
- Final exam 30%

Grade of Incomplete:

The College bulletin allows faculty to assign a grade of Incomplete when circumstances such as accident or illness make it impossible for the student to complete course work by the end of the semester; as long as the student has completed most of the course work at a passing level. An Incomplete cannot be used to allow students to "try again" the following semester.

Withdrawal:

The College bulletin gives the deadline for withdrawal without a faculty signature, and the last day for withdrawal with a signature. Policy on Lecture and Laboratory Withdrawals Students are advised that if, before the 7th week of

the semester, you withdraw from this lecture course, then you should also withdraw from the laboratory course. Withdrawals after the 7th week should be discussed with both your lecture and laboratory instructors.

Academic Integrity:

Plagiarism is presenting the work of others as if it is our own. Providing or receiving exam questions or answers to another person or entity is academic dishonesty. Plagiarism and other academic dishonesty, such as cheating on an exam, will be punished by a grade of F (failure) in the course and will be reported to the Dean. Know what academic dishonesty is and how to avoid it - in this matter, ignorance is never an acceptable excuse. Further details can be found in the Student Code of Conduct and on the College website: https://www.oldwestbury.edu/policies/academic-integrity.

Blackboard and E-mail:

Course documents will be posted on the Blackboard website, accessible from the Old Westbury web site. If you need login help for the Old Westbury intranet or help accessing course information, visit the computer lab, or the Student Computing section of the College website (www.oldwestbury.edu). I will communicate with your through your Old Westbury email.

Course Schedule:

Week	Class Topic	Chapter	Assignments
1	Introduction, Problems with classical physics	S1	
2	Mathematical preliminaries		
3	Quantum States	G1, S2	P.S. 1
4	Principles of Quantum Mechanics	G3, S3	P.S 2
5			P.S. 3
6			P.S. 4
7	Time Evolution - Schrodinger Equation	G2, S4	P.S.5
8			**Midterm Exam**
9	Entanglement	S6-7	P.S. 6
10	Particles and Waves	S-8	**P.S. 7**
11			P.S. 8
12	Square Well	G2.2	P.S 9
13	Harmonic Oscillator	G2.3, S10	P.S. 10
14	Hydrogen Atom	G4.2	P.S. 11
15	Student presentations		P.S. 12
16	Finals week		**Final exam**

Syllabus Author: Prof. Matthew Lippert

CP 4600 - Applied Mechanics

Fall

Course Description:

Physics CP 4600 is the study of statics and dynamics of rigid bodies and of stress and strain applied to “real” materials with elasticity and finite strength. Topics include simple equilibrium, structural analysis, inertia tensors, centroids, energy and momentum, and strength of materials, as well as concepts of stress and strain in structural members experiencing tension, compression, shear, bending, and twisting.

Credits: 3

Prerequisites: CP2260, MA2320

Learning Outcomes:

- Students will understand and be able to recall and apply the core principles of classical mechanics as applied to problems in mechanical engineering.
- Ability to apply mathematical skills and physics concepts together to model structural engineering problems and evaluate the possibility of failure in a variety of structures.

Classes:

Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are *strongly* encouraged to ask questions.

Textbook:

- *Vector Mechanics for Engineers – Statics*, 12th edition, Beer, Johnston & Mazurek, McGraw Hill
- *Mechanics of Materials*, 8th edition, Beer, Johnston et al., McGraw Hill

Assessments

Exams:

There will be two exams: one midterm exam and a final exam during exam week. Make-ups for exams will be given *only* by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework:

Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Grading:

Grades will be assigned at the end of the semester according to the following weights:

- Homework 40%
- Midterm exam 30%
- Final exam 30%

Grade of Incomplete:

The College bulletin allows faculty to assign a grade of Incomplete when circumstances such as accident or illness make it impossible for the student to complete course work by the end of the semester; as long as the student has completed most of the course work at a passing level. An Incomplete cannot be used to allow students to "try again" the following semester.

Withdrawal:

The College bulletin gives the deadline for withdrawal without a faculty signature, and the last day for withdrawal with a signature. Policy on Lecture and Laboratory Withdrawals Students are advised that if, before the 7th week of the semester, you withdraw from this lecture course, then you should also withdraw from the laboratory course. Withdrawals after the 7th week should be discussed with both your lecture and laboratory instructors.

Academic Integrity:

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Blackboard and E-mail:

Course documents will be posted on the Blackboard website, accessible from the Old Westbury web site. If you need login help for the Old Westbury intranet or help accessing course information, visit the computer lab, or the Student Computing section of the College website (www.oldwestbury.edu). I will communicate with your through your Old Westbury email.

Course Schedule

Week	Topic	Chapter
1	Statics of Particles	Vector Mechanics: Ch 1 & Ch 2
2	Rigid Bodies: Equivalent Systems of Forces	Vector Mechanics: Ch 3
3	Equilibrium of Rigid Bodies	Vector Mechanics: Ch 3
4	Distributed Forces: Centroids and Centers of Gravity	Vector Mechanics: Ch 4
5	Analysis of Structures	Vector Mechanics: Ch 5

6	Internal Forces and Moments	Vector Mechanics: Ch 6
7	Concept of Stress (Midterm)	Mechanics of Materials: Ch 1
8	Stress and Strain-Axial Loading	Mechanics of Materials: Ch 2
9	Torsion	Mechanics of Materials: Ch 3
10	Pure Bending	Mechanics of Materials: Ch 4
11	Analysis and Design of Beams for Bending	Mechanics of Materials: Ch 5
12	Shearing Stresses in Beams and Thin-Walled Members	Mechanics of Materials: Ch 6
13	Transformations of Stress and Strain	Mechanics of Materials: Ch 7
14	Principal Stresses Under a Given Loading	Mechanics of Materials: Ch 8
15	Final	

Syllabus Author: Prof. John Estes

CP 4900 - Econophysics

Spring

Course Description:

Physics has a long and storied tradition of applying statistical methods to understand complex systems. Financial markets are complex systems and are amenable to similar treatments. Econophysics is the application of ideas from statistical physics to the financial markets.

In this course, we will introduce the dynamics of markets from a physics perspective. We will introduce the statistical methods needed to model financial markets: classes of Brownian motion, probability distributions and limit theorems. Comparison with other physical systems will be used to develop intuitions for these methods.

Stochastic models for price dynamics will be introduced. Their applicability and limitations will be discussed. We will develop time-dependent models for equity valuations, such as the Black-Scholes equation which is used in options pricing. Real world markets such as equity stock markets, fixed income markets, and commodities markets will be considered.

Credits: 3

Prerequisites: BU4762, CS2510

Learning Outcomes:

- Students will have an understanding of the modern applications of physics to the interdisciplinary fields of finance and economics.
- Students will understand and be able to apply stochastic and computational methods to make predictions for non-analytic systems.

Classes:

Two 90-minute lectures per week. The classes will contain conceptual discussions, sample problems, and demonstrations. Dialogue is welcomed, and you are strongly encouraged to ask questions.

Textbook:

- Rosario N. Mantegna and H. Eugene Stanley, An Introduction to Econophysics, Correlations and Complexity in Finance, Cambridge University Press, Cambridge, UK

Assessments:

Exams:

There will be two exams: one in-class midterm exam and a take-home final exam during exam week. Make-ups for exams will be given only by arrangement and in accordance with university policy. All make-ups must be arranged with me in advance. If you are ill the day of the test, you must notify me by email before class time and bring a doctor's note after you are well, in order to arrange for a make-up test.

Homework:

Weekly problem sets will be assigned and will be due one week later. Late assignments will not be accepted without prior approval.

Presentation:

Students will research an application of the topics of the course and give an oral presentation to the class at the end of the semester. A written abstract will be submitted, and the presentations will be conducted in class.

Grading:

Grades will be assigned at the end of the semester according to the following weights:

- Homework 30%
- Midterm exam 20%
- Presentation 20%
- Final exam 30%

Grade of Incomplete:

The College bulletin allows faculty to assign a grade of Incomplete when circumstances such as accident or illness make it impossible for the student to complete course work by the end of the semester; as long as the student has completed most of the course work at a passing level. An Incomplete cannot be used to allow students to "try again" the following semester.

Withdrawal:

The College bulletin gives the deadline for withdrawal without a faculty signature, and the last day for withdrawal with a signature. Policy on Lecture and Laboratory Withdrawals Students are advised that if, before the 7th week of the semester, you withdraw from this lecture course, then you should also withdraw from the laboratory course. Withdrawals after the 7th week should be discussed with both your lecture and laboratory instructors.

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Blackboard and E-mail:

Course documents will be posted on the Blackboard website, accessible from the Old Westbury web site. If you need login help for the Old Westbury intranet or help accessing course information, visit the computer lab, or the Student Computing section of the College website (www.oldwestbury.edu). I will communicate with your through your Old Westbury email.

Course Schedule

Week	Class Topic	Chapter
1	Efficient market hypothesis	2
2	Random walk and Levy stochastic processes	3 & 4
3	Limit theorems and scales in financial data	4 &5
4	Stationarity and time correlation	6
5	Time correlation in financial time series	7
6	Stochastic models of price dynamics	8
7	Midterm	
8	Scaling and its breakdown	9
9	ARCH and GARCH processes	10
10	Financial markets and turbulence	11
11	Correlation and anticorrelation between stocks	12
12	Taxonomy of a stock portfolio	13
13	Options in idealized markets	14
14	Options in real markets	15
15	Final	

Syllabus Author: Prof. John Estes

Appendix 4: To-Be-Hired Faculty Description

TBH1, Assistant Professor (Starting year 4):

The Chemistry and Physics department seeks to hire a tenure-track Assistant Professor of Physics, to start in year 4 of the physics program. The position is open to all areas of physics, but, ideally, the new faculty member will strengthen and complement the existing research of the department. The position requires a PhD in Physics (or equivalent), significant teaching experience, a strong record of research accomplishment, and the ability to attract external funding. Additionally, a commitment to welcoming and mentoring students from underrepresented and underserved populations is essential. The new faculty member will teach a range of physics courses, both upper and lower division, maintain an active independent research program involving undergraduates, and participate in curricular development and assessment of the physics program.

Appendix 5: SUNY Transfer Course Equivalency Tables

The course equivalency tables are identical for all four concentrations. For clarity, we list them explicitly for each concentration.

General Physics Concentration:

Table 1:

Nassau Community College						**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01274)						B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**		**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3		EL1000	English Composition I	BC		3
ENG102	Composition II			3		EL2200	English Composition II			3
	History GER	WT		3			Western Traditions GER	WT		3
	History GER	AH		3			American History GER	AH		3
	Foreign Language GER	FL		3			Foreign Language GER	FL		3
	Arts GER	AR		3			Arts GER	AR		3
	Other World Civilizations GER	OW		3			Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3			Social Sciences GER	SS		3
	Humanities GER	H		3			Humanities GER	H		3
PHY151	Physics Science and Math 1	NS	x	4		CP2240, CP2241	General Physics 1, General Physics 1 Lab	NS	x	4
PHY152	Physics Science and Math 2		x	4		CP2250, CP2251	General Physics 2, General Physics 2 Lab		x	4
PHY223	Intro to Modern Physics		x	3		CP2260	General Physics 3 (anticipated)		x	3
MAT122	Calculus 1	M	x	4		MA2310	Calculus 1	M	x	4
MAT123	Calculus 2		x	4		MA2320	Calculus 2		x	4
MAT225	Multivariable Calculus		x	4		MA3330	Calculus 3		x	4
MAT226	Elementary Linear Algebra		x	4		MA3160	Linear Algebra		x	4
MAT234	Elementary Differential Equations		x	3		MA4360	Differential Equations		x	4
CHE151	General Chemistry 1		x	4		CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE152	General Chemistry 2		x	4		CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
		total credits		65				total credits		66
							Remaining credits needed for graduation			54

Table 2:

Suffolk Community College					**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01569)					B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**	**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3	EL1000	English Composition I	BC		3
ENG102	Composition II			3	EL2200	English Composition II			3
	History GER	WT		3		Western Traditions GER	WT		3
	History GER	AH		3		American History GER	AH		3
	Foreign Language GER	FL		3		Foreign Language GER	FL		3
	Arts GER	AR		3		Arts GER	AR		3
	Other World Civilizations GER	OW		3		Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3		Social Sciences GER	SS		3
	Humanities GER	H		3		Humanities GER	H		3
PHY130	Physics 1	NS	x	3	CP2240	General Physics 1	NS	x	3
PHY132	Physics 1 Lab	NS	x	1	CP2240	General Physics 1 Lab	NS	x	1
PHY230	Physics 2		x	3	CP2250	General Physics 2		x	3
PHY232	Physics 2 Lab		x	1	CP2251	General Physics 2 Lab		x	1
PHY245	Physics 3		x	3	CP2260	General Physics 3 (anticipated)		x	3
PHY246	Physics 3 Lab		x	1	CP2261	General Physics 3 Lab (anticipated)		x	1
PHY247	Physics 4		x	3					
PHY248	Physics 4 Lab		x	1					
MAT141	Calculus with Analytical Geometry 1	M	x	4	MA2310	Calculus 1	M	x	4
MAT141	Calculus with Analytical Geometry 2		x	4	MA2320	Calculus 2		x	4
MAT203	Calculus with Analytical Geometry 3		x	4	MA3330	Calculus 3		x	4
MAT206	Linear Algebra		x	4	MA3160	Linear Algebra		x	4
MAT204	Differential Equations		x	4	MA4360	Differential Equations		x	4
CHE133	College Chemistry 1		x	4	CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE134	College Chemistry 2		x	4	CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
CST112	Introduction to Programming		x	4	CS3610	Visual Basic			4
		total credits		75			total credits		71
						Remaining credits needed for graduation			49

Health Science Concentration:

Table 3:

Nassau Community College						**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01274)						B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**		**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3		EL1000	English Composition I	BC		3
ENG102	Composition II			3		EL2200	English Composition II			3
	History GER	WT		3			Western Traditions GER	WT		3
	History GER	AH		3			American History GER	AH		3
	Foreign Language GER	FL		3			Foreign Language GER	FL		3
	Arts GER	AR		3			Arts GER	AR		3
	Other World Civilizations GER	OW		3			Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3			Social Sciences GER	SS		3
	Humanities GER	H		3			Humanities GER	H		3
PHY151	Physics Science and Math 1	NS	x	4		CP2240, CP2241	General Physics 1, General Physics 1 Lab	NS	x	4
PHY152	Physics Science and Math 2		x	4		CP2250, CP2251	General Physics 2, General Physics 2 Lab		x	4
PHY223	Intro to Modern Physics		x	3		CP2260	General Physics 3 (anticipated)		x	3
MAT122	Calculus 1	M	x	4		MA2310	Calculus 1	M	x	4
MAT123	Calculus 2		x	4		MA2320	Calculus 2		x	4
MAT225	Multivariable Calculus		x	4		MA3330	Calculus 3		x	4
MAT226	Elementary Linear Algebra		x	4		MA3160	Linear Algebra		x	4
MAT234	Elementary Differential Equations		x	3		MA4360	Differential Equations		x	4
CHE151	General Chemistry 1		x	4		CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE152	General Chemistry 2		x	4		CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
		total credits		65				total credits		66
							Remaining credits needed for graduation			54

Table 4:

Suffolk Community College					**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01569)					B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**	**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3	EL1000	English Composition I	BC		3
ENG102	Composition II			3	EL2200	English Composition II			3
	History GER	WT		3		Western Traditions GER	WT		3
	History GER	AH		3		American History GER	AH		3
	Foreign Language GER	FL		3		Foreign Language GER	FL		3
	Arts GER	AR		3		Arts GER	AR		3
	Other World Civilizations GER	OW		3		Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3		Social Sciences GER	SS		3
	Humanities GER	H		3		Humanities GER	H		3
PHY130	Physics 1	NS	x	3	CP2240	General Physics 1	NS	x	3
PHY132	Physics 1 Lab	NS	x	1	CP2240	General Physics 1 Lab	NS	x	1
PHY230	Physics 2		x	3	CP2250	General Physics 2		x	3
PHY232	Physics 2 Lab		x	1	CP2251	General Physics 2 Lab		x	1
PHY245	Physics 3		x	3	CP2260	General Physics 3 (anticipated)		x	3
PHY246	Physics 3 Lab		x	1	CP2261	General Physics 3 Lab (anticipated)		x	1
PHY247	Physics 4		x	3					
PHY248	Physics 4 Lab		x	1					
MAT141	Calculus with Analytical Geometry 1	M	x	4	MA2310	Calculus 1	M	x	4
MAT141	Calculus with Analytical Geometry 2		x	4	MA2320	Calculus 2		x	4
MAT203	Calculus with Analytical Geometry 3		x	4	MA3330	Calculus 3		x	4
MAT206	Linear Algebra		x	4	MA3160	Linear Algebra		x	4
MAT204	Differential Equations		x	4	MA4360	Differential Equations		x	4
CHE133	College Chemistry 1		x	4	CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE134	College Chemistry 2		x	4	CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
CST112	Introduction to Programming		x	4	CS3610	Visual Basic			4
		total credits		75			total credits		71
						Remaining credits needed for graduation			49

Quantitative Finance Concentration:

Table 5:

Nassau Community College						**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01274)						B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**		**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3		EL1000	English Composition I	BC		3
ENG102	Composition II			3		EL2200	English Composition II			3
	History GER	WT		3			Western Traditions GER	WT		3
	History GER	AH		3			American History GER	AH		3
	Foreign Language GER	FL		3			Foreign Language GER	FL		3
	Arts GER	AR		3			Arts GER	AR		3
	Other World Civilizations GER	OW		3			Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3			Social Sciences GER	SS		3
	Humanities GER	H		3			Humanities GER	H		3
PHY151	Physics Science and Math 1	NS	x	4		CP2240, CP2241	General Physics 1, General Physics 1 Lab	NS	x	4
PHY152	Physics Science and Math 2		x	4		CP2250, CP2251	General Physics 2, General Physics 2 Lab		x	4
PHY223	Intro to Modern Physics		x	3		CP2260	General Physics 3 (anticipated)		x	3
MAT122	Calculus 1	M	x	4		MA2310	Calculus 1	M	x	4
MAT123	Calculus 2		x	4		MA2320	Calculus 2		x	4
MAT225	Multivariable Calculus		x	4		MA3330	Calculus 3		x	4
MAT226	Elementary Linear Algebra		x	4		MA3160	Linear Algebra		x	4
MAT234	Elementary Differential Equations		x	3		MA4360	Differential Equations		x	4
CHE151	General Chemistry 1		x	4		CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE152	General Chemistry 2		x	4		CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
		total credits		65				total credits		66
							Remaining credits needed for graduation			54

Table 6:

Suffolk Community College					**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01569)					B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**	**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3	EL1000	English Composition I	BC		3
ENG102	Composition II			3	EL2200	English Composition II			3
	History GER	WT		3		Western Traditions GER	WT		3
	History GER	AH		3		American History GER	AH		3
	Foreign Language GER	FL		3		Foreign Language GER	FL		3
	Arts GER	AR		3		Arts GER	AR		3
	Other World Civilizations GER	OW		3		Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3		Social Sciences GER	SS		3
	Humanities GER	H		3		Humanities GER	H		3
PHY130	Physics 1	NS	x	3	CP2240	General Physics 1	NS	x	3
PHY132	Physics 1 Lab	NS	x	1	CP2240	General Physics 1 Lab	NS	x	1
PHY230	Physics 2		x	3	CP2250	General Physics 2		x	3
PHY232	Physics 2 Lab		x	1	CP2251	General Physics 2 Lab		x	1
PHY245	Physics 3		x	3	CP2260	General Physics 3 (anticipated)		x	3
PHY246	Physics 3 Lab		x	1	CP2261	General Physics 3 Lab (anticipated)		x	1
PHY247	Physics 4		x	3					
PHY248	Physics 4 Lab		x	1					
MAT141	Calculus with Analytical Geometry 1	M	x	4	MA2310	Calculus 1	M	x	4
MAT141	Calculus with Analytical Geometry 2		x	4	MA2320	Calculus 2		x	4
MAT203	Calculus with Analytical Geometry 3		x	4	MA3330	Calculus 3		x	4
MAT206	Linear Algebra		x	4	MA3160	Linear Algebra		x	4
MAT204	Differential Equations		x	4	MA4360	Differential Equations		x	4
CHE133	College Chemistry 1		x	4	CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE134	College Chemistry 2		x	4	CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
CST112	Introduction to Programming		x	4	CS3610	Visual Basic			4
		total credits		75			total credits		71
						Remaining credits needed for graduation			49

Applied/Computational Concentration:

Table 7:

Nassau Community College						**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01274)						B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**		**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3		EL1000	English Composition I	BC		3
ENG102	Composition II			3		EL2200	English Composition II			3
	History GER	WT		3			Western Traditions GER	WT		3
	History GER	AH		3			American History GER	AH		3
	Foreign Language GER	FL		3			Foreign Language GER	FL		3
	Arts GER	AR		3			Arts GER	AR		3
	Other World Civilizations GER	OW		3			Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3			Social Sciences GER	SS		3
	Humanities GER	H		3			Humanities GER	H		3
PHY151	Physics Science and Math 1	NS	x	4		CP2240, CP2241	General Physics 1, General Physics 1 Lab	NS	x	4
PHY152	Physics Science and Math 2		x	4		CP2250, CP2251	General Physics 2, General Physics 2 Lab		x	4
PHY223	Intro to Modern Physics		x	3		CP2260	General Physics 3 (anticipated)		x	3
MAT122	Calculus 1	M	x	4		MA2310	Calculus 1	M	x	4
MAT123	Calculus 2		x	4		MA2320	Calculus 2		x	4
MAT225	Multivariable Calculus		x	4		MA3330	Calculus 3		x	4
MAT226	Elementary Linear Algebra		x	4		MA3160	Linear Algebra		x	4
MAT234	Elementary Differential Equations		x	3		MA4360	Differential Equations		x	4
CHE151	General Chemistry 1		x	4		CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE152	General Chemistry 2		x	4		CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
		total credits		65				total credits		66
							Remaining credits needed for graduation			54

Table 8:

Suffolk Community College					**SUNY Old Westbury**				
A.S. Math and Science (Physics) (SED code: 01569)					B.S. in Physics				
Course	**Course Title**	**GER**	**Major or TPath**	**credits**	**Course**	**Course Title**	**GER**	**Major or TPath**	**credits**
ENG101	Composition I	BC		3	EL1000	English Composition I	BC		3
ENG102	Composition II			3	EL2200	English Composition II			3
	History GER	WT		3		Western Traditions GER	WT		3
	History GER	AH		3		American History GER	AH		3
	Foreign Language GER	FL		3		Foreign Language GER	FL		3
	Arts GER	AR		3		Arts GER	AR		3
	Other World Civilizations GER	OW		3		Other World Civilizations GER	OW		3
	Social Sciences GER	SS		3		Social Sciences GER	SS		3
	Humanities GER	H		3		Humanities GER	H		3
PHY130	Physics 1	NS	x	3	CP2240	General Physics 1	NS	x	3
PHY132	Physics 1 Lab	NS	x	1	CP2240	General Physics 1 Lab	NS	x	1
PHY230	Physics 2		x	3	CP2250	General Physics 2		x	3
PHY232	Physics 2 Lab		x	1	CP2251	General Physics 2 Lab		x	1
PHY245	Physics 3		x	3	CP2260	General Physics 3 (anticipated)		x	3
PHY246	Physics 3 Lab		x	1	CP2261	General Physics 3 Lab (anticipated)		x	1
PHY247	Physics 4		x	3					
PHY248	Physics 4 Lab		x	1					
MAT141	Calculus with Analytical Geometry 1	M	x	4	MA2310	Calculus 1	M	x	4
MAT141	Calculus with Analytical Geometry 2		x	4	MA2320	Calculus 2		x	4
MAT203	Calculus with Analytical Geometry 3		x	4	MA3330	Calculus 3		x	4
MAT206	Linear Algebra		x	4	MA3160	Linear Algebra		x	4
MAT204	Differential Equations		x	4	MA4360	Differential Equations		x	4
CHE133	College Chemistry 1		x	4	CP2120	Principles of Chemistry 1, Principles of Chemistry 1 Lab		x	4
CHE134	College Chemistry 2		x	4	CP2130	Principles of Chemistry 2, Principles of Chemistry 2 Lab		x	4
CST112	Introduction to Programming		x	4	CS3610	Visual Basic			4
		total credits		75			total credits		71
						Remaining credits needed for graduation			49

SCHOOL OF ARTS & SCIENCES

Proposal for

Bachelor of Science in Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations

Appendix 6: **External Evaluation Reports** (Section 7)

and

Appendix 7: **Institutional Response to External Evaluator Reports** (Section 8)

April 25, 2021

SUNY OLD WESTBURY

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APPENDIX 6

External Evaluation Reports (Section 7)

External Evaluation Report

Form 2D

Version 201-08-02

The External Evaluation Report is an important component of a new academic program proposal. The external evaluator's task is to examine the program proposal and related materials, visit the campus to discuss the proposal with faculty and review related instructional resources and facilities, respond to the questions in this Report form, and submit to the institution a signed report that speaks to the quality of, and need for, the proposed program. The report should aim for completeness, accuracy and objectivity.

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Institution: SUNY Old Westbury

Evaluator Name (Please print.): Nathan B. Magee

Evaluator Title and Institution: Professor of Physics, The College of New Jersey

Evaluator Signature: 

Proposed Program Title: Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations

Degree: Bachelor of Science (B.S.)

Date of evaluation: 4/15/2021

I. Program

1. Assess the program's **purpose, structure, and requirements** as well as formal mechanisms for program **administration and evaluation.** Address the program's academic rigor and intellectual coherence.

A. Purpose

This evaluation is provided for a proposal of a new Physics B.S. degree program at SUNY Old Westbury. The title of the new program proposal is "Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations."

The primary purpose of the new proposal is to establish an undergraduate B.S. degree program in physics at SUNY Old Westbury, where none currently exists. Student interest and enrollment in STEM disciplines at Old Westbury have increased substantially over the past decade, and the College is well-positioned to respond to this demand with an increased set of degree options for STEM students at Old Westbury. The proposal describes a carefully-crafted plan to offer several interdisciplinary degree concentrations in areas of physics that are particularly relevant to the interests of Old Westbury students and faculty, and are also aligned with fields that have strong regional career opportunities for graduates.

Physics degree programs are currently offered at approximately 750 higher educational institutions across the United States, including 14 of the other SUNY campuses (AIP data, https://www.aip.org/statistics/reports/size-undergraduate-physics-programs). Most institutions of similar size and mission offer physics degrees, including most of SUNY's Comprehensive Colleges. Particularly given the highly diverse ~5000 student enrollment at Old Westbury, situated in the midst of a rich landscape of interdisciplinary STEM career opportunities, the availability of a physics degree program at this campus would be a worthy priority for the institution and for the SUNY system.

B. Structure:

The academic structure of the proposed program is as follows:

a) Foundational Core
A set of introductory physical science and mathematics courses and labs that all physics majors (and many other STEM majors) would take. These courses generally already exist at Old Westbury as service courses for other STEM majors, and their need, enrollment demand, and teaching infrastructure is already firmly established. This set of foundational courses is fairly standard and well-aligned with national benchmarks for lower-division physics majors.

b) Upper Division Core
A set of intermediate and advanced physics courses and labs that would be taken by all upper-level physics majors. Several of these courses already exist in the Chemistry program and could be offered jointly for both physics and chemistry students (e.g. Physical Chemistry/Thermodynamics and Math Methods in Physical Sciences). Several of the other courses would be new class offerings (e.g. Mechanics, Electromagnetism, Relativity, Experimental Physics Lab). For each new course, a course structure and syllabus has been provided in the program proposal. The principal national disciplinary organizations in physics (American Institute for Physics, 'AIP', and American Physical Society, 'APS') do not offer degree accreditation or standard curricula for physics programs, however, this set of upper-level courses is closely aligned with typical B.S. physics degree structures nationwide. The Relativity course is perhaps the only class that might more typically appear as elective rather than a core requirement. However, given the expertise of the proposing faculty and trends in the discipline, this course should prove to be a unique and compelling part of the core.

c) Degree Concentration Courses

In addition to core courses, all physics majors would select courses from among 4 major concentrations:

i.) General Physics Concentration
ii.) Applied/Computational Concentration
iii.) Health Science Concentration
iv.) Quantitative Finance Concentration

These concentrations are intended to help students prepare for a variety of potential career paths, including those that have unique job opportunities in the region. The selection of concentration courses is very interdisciplinary, and would establish strong connections between the new physics program and established offerings in Biology, Chemistry, Computer Science, Mathematics, and Finance/Management.

C. Requirements

The course requirements and sequencing for the program are clearly laid out in the program proposal. The total credit requirements for each section of the program are as follows:

a) Foundational Core (28 cr.)
b) Upper Division Core (27 cr.)
i.) General Physics Concentration (14 cr.)
ii.) Applied/Computational Concentration (19 cr.)
iii.) Health Science Concentration (21 cr.)
iv.) Quantitative Finance Concentration (32 cr., 8 fewer core cr. req.)

This results in a total of 69 -79 credits required to complete the major, depending on concentration choice. These course requirements establish an enticing, rigorous, and coherent set of physics courses in each concentration, and also leave sufficient space for physics majors to complete general education courses and still allow possibilities for other minors and double majors.

D. Administration and Evaluation

The B.S. in Physics would be administered through the existing Department of Chemistry and Physics at Old Westbury. This department currently offers B.A. and B.S. degrees in Chemistry and a B.S. in Biochemistry, and a minor in physics. The department has had a recent influx of physics faculty and physics-interested students. The existing Chemistry and Physics department would be a natural administrative home for the new Physics B.S. degree and for physics faculty and students. This should cause minimal administrative disruption for current faculty and students, and help to support continued synergy between academic and scholarly opportunities across physics and chemistry. It is conceivable that a separate Department of Physics might eventually become desirable if the new program grows significantly over coming years, but is definitely not necessary in the short-medium term. Continuing program evaluation would occur through the University's existing annual and five-year assessment cycles for departments.

2. Comment on the **special focus** of this program, if any, as it relates to the discipline.

The core content of the proposed program is fairly typical for an undergraduate physics major in the United States. However, the establishment of several interdisciplinary degree tracks is a fairly unique structure for a B.S. physics degree program. These concentrations are designed to provide transparent pathways for students toward different types of career opportunities. This should help with student recruiting, since physics programs sometimes struggle to clearly articulate the range of careers that are available following completion of a physics bachelor degree. The Health Science and Quantitative Finance concentrations are particularly unique. Very few other Physics B.S. programs could offer similar curricular concentrations, and there is a strong alignment of these fields with robust and growing employment sectors in New York and Long Island. This alignment should offer excellent career prospects for graduates, and good potential for building institutional relationships or articulation agreements with the regional business sector.

3. Comment on the plans and expectations for **self-assessment and continuous improvement**.

The new physics degree program would be evaluated through the Department of Chemistry and Physics and the University's existing annual and five-year assessment cycles. As the program grows and matures, self-assessment can be used to evaluate the sufficiency and efficiency of the program's structure, requirements, staffing, and facilities.

4. Discuss **the relationship** of this program to other programs of the institution and collaboration with other institutions, and assess available support from related programs.

The proposed physics B.S. degree program would be housed within the existing department of Chemistry and Physics, and both core and concentration courses would include significant collaboration with chemistry students and faculty. Core and concentration courses would also result in a modest increase in the number of students taking Mathematics courses. The concentrations also would include significant new interdisciplinary collaborations with the School of Business, Biology, and Computer Science. Chairs and faculty in each of these programs expressed strong support for the new Physics program, and appear to be genuinely excited about the prospect for new collaborations and new student opportunities. At least at first, the new physics major is not expected to be especially large relative to existing STEM programs, so none of these related programs are concerned about being able to accommodate slightly increased enrollments in their courses.

5. What is the evidence of **need** and **demand** for the program locally, in the State, and in the field at large? What is the extent of occupational demand for graduates? What is the evidence that demand will continue?

The program proposal does a nice job of highlighting the excellent set of research statistics from AIP that demonstrate the continuing national growth of physics as an undergraduate major, as well as the diverse set of career paths that these graduates pursue. As mentioned above, the proposed concentrations in Health Sciences and Quantitative Finance are particularly unique designs that are well-attuned to regional job opportunities on Long Island and in New York City.

In the medium-term future, I think that the addition of a Physics Teacher Education concentration could further address enormous regional demand and provide graduates who would make a big impact on local high school science education. The severe shortage of highly qualified physics teachers, alongside existing teacher ed. infrastructure at Old Westbury, and broad national support opportunities (e.g. Physics Teacher Education

Coalition) make this a promising area for future growth of the program. It makes good sense to first establish the B.S. physics major as proposed, and demonstrate a stable and effective program before potentially pursuing an accredited physics teacher education program.

II. Faculty

6. **Evaluate the faculty**, individually and collectively, with regard to training, experience, research and publication, professional service, and recognition in the field.

   The core physics faculty at the outset of the program would include the following faculty:

Name	Title	Degree	Research Area
Michael Colaneri	Associate Prof.	Ph.D., Biophysics SUNY Buffalo	Physical structures and dynamics of biological crystalline materials
John Estes	Assistant Prof.	Ph.D., Physics UCLA	Theoretical physics, string theory, gauge theories and applications to Cosmology
Camille Jones	Visiting Asst. Prof.	Ph.D., Physical Chem. Univ. Toledo	Materials structures, high temperature thermodynamics and phase changes
Michael Kavic	Associate Prof.	Ph.D. Physics Virginia Tech.	Radio astronomy, gravitational waves, and astrophysical tests of quantum gravity and high-energy physics
Matthew Lippert	Assistant Prof.	Ph.D., Physics UC Santa Barbara	Models of holographic gauge/gravity duality and application to non-equilibrium dynamics & strongly interacting systems

   Professors Estes, Kavic, and Lippert are tenured/tenure-track faculty who would concentrate all of their teaching and research in physics. Dr. Colineri's research and teaching is at the interface of Physics and Biology, and Dr. Jones is a visiting Physical Chemist, who would contribute to core instruction in physics and in material physics & physical chemistry research. Approximately ~15 other faculty in Biology, Chemistry, Mathematics, Computer Science, and Business would teach interdisciplinary foundational and concentration courses.

7. **Assess the faculty in terms of number and qualifications** and **plans for future staffing**. Evaluate **faculty responsibilities** for the proposed program, taking into account their other institutional and programmatic commitments. Evaluate faculty **activity in generating funds** for research, training, facilities, equipment, etc. Discuss any **critical gaps and plans for addressing them**.

   The current number, qualifications, and expertise of the proposed core and affiliated physics faculty is suitable for the initial roll-out of a new physics degree program Old Westbury. According to AIP statistics, in 2018, the average number of physics faculty members at PUI physics programs was 6.4 FTE. Naturally, the typical number of FTE faculty members in physics normally scales with the number of B.S. graduates and with the number of physics service courses offered (https://www.aip.org/statistics/data-graphics/average-number-bachelors-conferred-number-fte-faculty-members-physics).

It is noteworthy that all of the core physics faculty are actively publishing research in leading journals and many of them also have an established record of attracting external research funding, including from prestigious national funding agencies (NASA, NSF, Research Corp.)

8. Evaluate credentials and involvement of **adjunct faculty** and **support personnel**.

At this time, several adjunct faculty (to be hired) are anticipated to to play a minor role in the physics program, providing instruction for a small proportion of the lower division and service courses. If enrollments grow at faster-than-anticipated rates, an additional adjunct instructor or two would need to be hired. In this region, it should not be very difficult to hire well-qualified adjunct faculty in physics as this becomes necessary.

The chemistry and physics department currently shares administrative and lab support personnel. This current arrangement should continue to function adequately in the short-to-medium term. If the program grows to the extent that 10+ graduates are completing the program each year and one or two new full-time faculty are needed, then an additional support person or adjusted administrative structure may need to be considered.

III. Students

9. Comment on the **student population the program seeks to serve**, and assess plans and projections for student recruitment and enrollment.

The proposed program is intended to serve undergraduate students interested in STEM at Old Westbury. According to interviews of students, faculty, and administrators, all stakeholders are in agreement that more disciplinary program opportunities would be a benefit to this growing sector of the Westbury student population. The core group of physics faculty has already attracted a significant cohort of physics minors, most of whom attested that they would have pursued a physics major if it were to have been available to them. Concrete program enrollment targets are identified in the proposal, and these are reasonably grounded in national AIP statistics on the size of physics majors at comparable institutions, and in the context of enrollment sizes and trends at Old Westbury. The proposal aims for the physics program to reach approximately 7 graduates per year by year 5. In my view, this is a moderately aggressive but not infeasible target. If the program successfully grows at this rate or faster within this five-year time frame, additional faculty (1 full time & several adjunct) will become necessary at about year 3. As the proposal has identified, a slower growth rate that does not meet the enrollment targets would still result in a viable program, and could be feasible to run at current staffing levels.

I did speak with Professors Lippert, Estes, and Kavic about student recruiting goals and plans. Since many Old Westbury students decide on majors after taking foundational coursework in their first year, it will be particularly crucial to attract physics majors through an inclusive and highly engaging introductory physics sequence. Fortunately, this framework already appears to be in place, with most of the current minors attracted into physics through an unexpected enjoyment of an introductory physics class. In addition, the physics faculty discussed a plan to reach out to local high school physics classes, and to widely advertise research and course opportunities to Westbury students. In my experience, these faculty-led outreach efforts can require a good deal of energy and organization, but they can definitely be productive if targeted toward schools, teachers, and student groups who have already proven to be likely to be interested in STEM opportunities at Old Westbury.

10. What are the prospects that recruitment efforts and admissions criteria will supply **a sufficient pool of highly qualified applicants and enrollees**?

I am optimistic that a sufficient pool of students will be interested in the new physics program and will enroll. Of course, the year-by-year enrollment numbers are hard to predict with certainty, but I think all the pieces are in place for a successful roll-out and for a sustainable period of program growth. The program start-up appears to be planned in a way that it will be able to adjust to somewhat slower or somewhat faster growth than projected.

11. Comment on provisions for encouraging participation of **persons from underrepresented groups**. Is there adequate attention to the needs of part-time, minority, or disadvantaged students?

As an institution, SUNY Old Westbury is highly invested in providing outstanding educational opportunities to underrepresented minority groups (URM). This is not just a talking point -- more than 50% of Old Westbury students meet URM criteria, including nearly 60% of students in existing STEM majors. My interviews with physics faculty and college administrators clearly indicated that they are attuned to providing careful consideration and attention to support the success of these students. As a discipline, physics has one of the lowest rates of URM participation nationally (~13% of Physics B.S. degrees), so this new program therefore has great potential to make an important impact in this critical area.

12. Assess the system for monitoring **students' progress and performance** and for **advising students** regarding academic and career matters.

Full-time physics faculty members will serve as primary academic advisers for each of the declared physics majors. Faculty advisers will mentor students with respect to course selection, program progress, research opportunities, and career planning. New and at-risk students will also receive supplementary support (e.g. tutoring, coaching, career planning services) through the new Student Success Center and through the Academic Advising Center.

13. Discuss prospects for graduates' post-completion success, whether **employment, job advancement, future study, or other outcomes related to the program's goals.**

The proposal is attentive to career paths and employment opportunities for B.S. physics graduates. The degree concentrations help focus student coursework toward a variety of highly-marketable skillsets. Students who complete this B.S. degree will have excellent career prospects. The proposal authors rightly point out that large private sector firms, small businesses, and academic institutions all recognize the relative scarcity of URM physics graduates and employees, and are therefore eager to hire well-qualified URM physics graduates.

IV. Resources

14. Comment on the adequacy of physical **resources** and **facilities**, e.g., library, computer, and laboratory facilities; practica and internship sites or other experiential learning opportunities, such as co-ops or service learning; and support services for the program, including use of resources outside the institution.

Although I was not able to visit in person due to the ongoing Covid-19 pandemic, I was provided with a detailed overview of current and projected facilities available for the program and I had good discussions about facilities with students, faculty, dean, and provost. Current classrooms, and laboratory spaces, and equipment is adequate to support the first few years of the proposed physics program. Existing library and computational resources are also sufficient for program needs. Some investment in additional lab equipment will be necessary for the new upper-level lab courses (Electronics and Experimental Physics Lab), and some budget should be dedicated to maintenance and renewal of existing lab equipment.

There appears to be considerable excitement about a major renovation that is planned for the Natural Science building on campus. The physics program will clearly benefit from plans for a state-of-the-art "SCALE-UP" classroom which will be designed to facilitate studio-style integration of lecture and laboratory physics. Several spaces for student use have also been designed into the renovation; these spaces promise to promote student community and help provide a comfortable campus 'home' for commuter students. The exact timing and phasing of this renovation is still to be determined but is likely to be complete in a ~3-5 year time frame. During construction phases, temporary class and lab facilities will be provided, but administrators and faculty expressed confidence that these will be adequate to support the program during the renovation. When the renovation is completed, the new space should buttress the growth of the program, helping to making it a highly functional and desirable place to study.

15. What is the **institution's commitment** to the program as demonstrated by the operating budget, faculty salaries, the number of faculty lines relative to student numbers and workload, and discussions about administrative support with faculty and administrators?

Based on my interviews, there is strong and widespread institutional and administrative support for the new physics program. The scaled roll-out of the new program is designed such that it will not generate major new costs in the short term. As the program demonstrates growth, the proposal calls for a moderate investment in new lab equipment at year three, and one additional tenure-track faculty member at year 4. These requests are commensurate with the projected growth of student majors. If the initial growth rate is slower than projected, the investment in a new faculty line could be delayed. This proposed gradual approach appears to present low risk to the institution, and is supported by faculty, department chairs, dean, and provost.

V. Summary Comments and Additional Observations

16. Summarize the **major strengths and weaknesses** of the program as proposed with particular attention to feasibility of implementation and appropriateness of objectives for the degree offered.

This evaluation report is provided in consideration of a proposal for a new B.S. physics program at SUNY Old Westbury. ***Overall, in my view, this is an excellent and carefully-considered program proposal that is likely to succeed as described.***

Strengths:

1. *Innovative structure:* As proposed, the new physics program would offer a rigorous and inclusive B.S. degree with 4 degree concentrations. The concentration structure is a distinctive strength, providing interdisciplinary breadth and unique career pathways that should prove attractive to potential degree candidates.

2. *Design for scaled growth:* The proposed gradual roll-out of the new program is calibrated to avoid unnecessary costs or risks to the institution. The proposal makes a convincing case that existing

resources and infrastructure are sufficient to start the program on a good path, and that moderate investments at years 3-5 can be made in sync with the actual growth of the program.

3. *Excellent core physics faculty and supporting programs:* Based on my interviews with faculty and students, and my review of faculty CVs, I was sincerely impressed with the research and teaching of the faculty who will be central to growth and success of the new program. The existing physics minors genuinely like the faculty members, and they are excited by opportunities to participate in cutting-edge research and they appreciate the student-centered, well-taught physics classes.

4. *Institutional support:* In my discussions and interviews, chairs and faculty from affiliated programs (Chemistry, Biology, Math & CS, Business) provided strong endorsements and support for the proposal, and they appear to be eager to participate in the innovative interdisciplinary concentrations. Dean Frisken and Provost Quarless also expressed enthusiasm for the proposed program, and demonstrate a clear sense of the supports needed for the new program to thrive.

Weaknesses:

1. *Enrollment uncertainty:* The projected enrollment is subject to considerable uncertainty, especially given the volatile collegiate enrollment environment associated with the Covid-19 pandemic. I think that both of these potential concerns would be true of most new programs, and in this case are addressed successfully by limiting the need for investments until growing enrollments are demonstrated.

2. *Lack of physics teaching concentration:* At first, the omission of a physics teaching concentration looks like a potential missed opportunity. In talking to faculty and administrators, it seems clear that they recognize this as a potential area for growth once the program is successfully established. Given the additional requirements for accreditation and certification of new teacher preparation programs, it does make good sense to revisit this growth opportunity in several years.

Program Feasibility and Appropriate Objectives:

In my view, the proposal lays out a compelling and well-crafted B.S. program in physics. Careful attention has been paid to ensuring that a rigorous and inclusive curriculum can be offered to students in a manner that makes it feasible for students to complete, and also feasible for faculty and the institution to offer. Objectives for student learning outcomes and career preparation are excellent and fit very nicely with the regional setting, institutional mission, and student population. The projections for enrollment growth are moderately aggressive, but I think they have a solid chance of being realized, and a sound plan is in place for how to adapt if growth is somewhat slower than expected.

17. If applicable, particularly for graduate programs, comment on the ways that this program will make a **unique contribution** to the field, and its likelihood of achieving State, regional and/or national **prominence**.

The proposed program would not offer graduate degrees. Nevertheless, the new physics program would offer several highly distinctive contributions:

- The Quantitative Finance concentration would be very unique for a B.S. Physics program, and is nicely aligned with excellent regional career opportunities as well as expertise of faculty at Old Westbury.

- The Health Science and Applied/Computational major concentrations are also distinctive interdisciplinary programs that will provide unique training and career prospects for B.S. graduates.

- The high fraction of URM students (60%) in STEM at SUNY Old Westbury suggests that the diverse graduates of this new program will make a significant impact on physics as a discipline that suffers from a long-standing lack of diversity.

18. Include any **further observations** important to the evaluation of this program proposal and provide any **recommendations** for the proposed program.

Thank you for your consideration of my review. I am sincerely excited about the prospects for this new program and SUNY Old Westbury, and I look forward to following its progress. Please don't hesitate to contact me at magee@tcnj.edu with any additional questions or concerns. Sincerely, Nathan B. Magee

External Reviewer Conflict of Interest Statement

I am providing an external review of the application submitted to the State University of New York by:

SUNY Old Westbury

(Name of Institution or Applicant)

The application is for (circle A **or** B below)

A) New Degree Authority

B) Registration of a new academic program by an existing institution of higher education:

Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations

(Title of Proposed Program)

I affirm that I:

1. am not a present or former employee, student, member of the governing board, owner or shareholder of, or consultant to the institution that is seeking approval for the proposed program or the entity seeking approval for new degree authority, and that I did not consult on, or help to develop, the application;

2. am not a spouse, parent, child, or sibling of any of the individuals listed above;

3. am not seeking or being sought for employment or other relationship with the institution/entity submitting the application?

4. do not have now, nor have had in the past, a relationship with the institution/entity submitting the application that might compromise my objectivity.

Name of External Reviewer (please print):

Nathan B. Magee

Signature: Nathan B. Magee

External Evaluation Report

Form 2D

Version 201-08-02

The External Evaluation Report is an important component of a new academic program proposal. The external evaluator's task is to examine the program proposal and related materials, visit the campus to discuss the proposal with faculty and review related instructional resources and facilities, respond to the questions in this Report form, and submit to the institution a signed report that speaks to the quality of, and need for, the proposed program. The report should aim for completeness, accuracy and objectivity.

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Institution: SUNY Old Westbury

Evaluator Name (Please print.): Neil Aaronson

Evaluator Title and Institution: Professor of Physics, Stockton University

Evaluator Signature: 

Proposed Program Title: Physics

Degree: Bachelor of Science

Date of evaluation: April 5th, 2021

I. Program

1. Assess the program's **purpose, structure, and requirements** as well as formal mechanisms for program **administration and evaluation.** Address the program's academic rigor and intellectual coherence.

The degree program that has been proposed in most ways aligns with Physics major programs at similar schools across the country. Physics is the most fundamental of the sciences and as such fills an important role in any comprehensive school of sciences. Students studying physics are prepared not only to pursue research in physics and engineering, but to parlay their analytical and quantitative skills to other related fields.

The proposed program follows a familiar structure: students are expected to take foundational physics and mathematics courses first (*e.g.* Physics I, II, III, and Calculus I, II, and III, often in co-requisite pairs) and then certain standard upper-level undergraduate courses (at least Mechanics, Electricity & Magnetism, Thermodynamics, and Quantum Mechanics). Besides those, students in most programs take other major cognates as dictated by their interests or their particular track. That standard structure is reflected in the current proposal and I would expect students following the proposed course layout would leave the program well prepared compared to physics majors at similar institutions.

The proposed degree program requirements are in line with the College's normal admission standards, which is identical to the requirements of their sister-to-be program, Chemistry. As it is generally expected that students taking the first introductory course in the physics sequence, Physics I, be at least co-enrolled in a Calculus I course, it may be worth exploring the possibility of putting in place a requirement that students be eligible to take Calculus I before declaring a Physics major. I understand that there has been some problems with students in introductory Chemistry courses whose math background is too weak at the time they take the course, and this may become a problem for students in introductory Physics courses as well. However, I was encouraged to learn that students can, with careful advising, potentially graduate in four years even if they have to spend their first year taking classes to catch up on math requirements.

2. Comment on the **special focus** of this program, if any, as it relates to the discipline.

The most unique and interesting aspect of the proposed physics program, which I feel would make it distinct from many physics programs not just in the region but across the country, is the proposed concentrations. The General Physics and Applied/Computational concentrations are typical for most physics programs that wish to prepare their students for graduate studies or jobs in industry. The Health Science and Quantitative Finance concentrations, while perhaps not unique, are certainly uncommon among physics programs.

Although Heath Science is a very popular discipline at many schools now, it is rarely taught with an emphasis on physics. Health Science concentrations within Physics programs are quite rare. They give students the opportunity to prepare for careers in medical imaging, nuclear medicine, and other medical disciplines. This kind of preparation is becoming more important as the medical field is becoming more technical and computerized. It is worth noting as well that Physics majors have high rates of acceptance to medical schools and tend to score high on the MCAT exam relative to other majors, including Biology. I know of few physics programs that cater to students interested in medicine with a program concentration.

The Quantitative Finance concentration is also rare among traditional Physics programs. For the past few decades, Wall Street has been keen to recruit physics students to make use of their quantitative skills, especially students with experience in numerical modeling and simulation of chaotic systems. Physics majors also find success in finance and economics graduate programs. Creating a degree concentration that specifically prepares physics students for careers in finance and economics is a good tactic both for recruiting potential students and for ensuring student success after graduation, particularly for a school so close to Manhattan.

3. Comment on the plans and expectations for **self-assessment and continuous improvement**.

SUNY Old Westbury has an existing assessment structure involving annual self-assessment and an additional thorough review including an external reviewer once every five years. Annual self-assessment involves a "closing the loop" component in which the program is expected to evaluate its progress in meeting goals it set for itself based on the previous year review. The five year review cycle offers the opportunity to evaluate long-term goals and program needs as well as to gather input from an external evaluator. Given that women and minorities are often underrepresented in the physical sciences, I would recommend that the program regularly assess their recruitment efforts and success in maintaining a diverse population of majors.

4. Discuss **the relationship** of this program to other programs of the institution and collaboration with other institutions, and assess available support from related programs.

Physics is traditionally intertwined with, at the least, Mathematics. Traditional Physics majors typically need to take about five courses in mathematics (Calculus I, II, III; Differential Equations, and Linear Algebra). In Chemistry, Physics majors typically take two semesters of Chemistry, and that is reflected in this course proposal. Those students in the Health Science concentration take fewer math courses in exchange for more chemistry courses, which seems like a logical plan for students in that concentration.

The Applied/Computational, Health Sciences, and Quantitative Finance concentrations all rely to some degree on Physics students taking courses in other programs. From my conversations with the chairs of those departments, I am confident that there will be sufficient enrollment availability for the expected number of physics students needed those courses. I am also pleased that those program chairs are very supportive of the proposed Physics program and these concentrations. When I spoke to them, I was pleased to hear that they did not believe that they would lose their own majors to the new Physics program, but they expected Physics to draw in a new pool of students.

The program faculty have already laid the groundwork for exploring possibilities for collaboration with other schools, labs, and institutes. This will likely be a useful resource as their program grows and their students seek research opportunities in addition to those made available by working with program faculty. I would highly recommend the Physics faculty to continue to pursue such partnerships.

5. What is the evidence of **need** and **demand** for the program locally, in the State, and in the field at large? What is the extent of occupational demand for graduates? What is the evidence that demand will continue?

As noted in the program proposal, over the past 20 years, the number of physics degrees awarded has approximately doubled, while the number of physics degree programs has remained constant. Within a year of graduating, 47% of physics majors are in graduate programs of one kind or another, and 48% are employed, mostly in the private sector. Employers in many majors seek physics majors for their unique quantitative problem solving skills. These employment trends are extremely encouraging for prospective physics students. In addition, there has been a persistent need for physics educators at the high school level for the past few decades at least. I would accordingly encourage a new Physics program to work on developing a Physics Education track in cooperation with their college's Education program.

II. Faculty

6. **Evaluate the faculty**, individually and collectively, with regard to training, experience, research and publication, professional service, and recognition in the field.

I have met with Michael Colaneri, Michael Kavic, Matthew Lippert, Fernando Espinoza, and John Estes. Each of them is an excellent physicist, scholar, and teacher in their own right. Each is fully dedicated and each brings an important set of skills and qualifications to the proposed new Physics program. Equally important is their sense of collegiality and cooperation, which is evident in their proposal as well as the conversations I had with both them and students. They have already made impressive efforts to involve students in impressive scholarly activities, despite not having a pool of physics majors from which to draw.

I am confident that that the faculty involved will not only be able to teach all of the courses required in a Physics major program, but will be able to offer a variety of research opportunities to their students. I have no doubt in their ability and drive to prepare students for graduate school, industry, health professions, or the financial world.

7. **Assess the faculty in terms of number and qualifications** and **plans for future staffing**. Evaluate **faculty responsibilities** for the proposed program, taking into account their other institutional and programmatic commitments. Evaluate faculty **activity in generating funds** for research, training, facilities, equipment, etc. Discuss any **critical gaps and plans for addressing them**.

The current number of faculty is appropriate for the expected scale of the program while it is in its infancy. They have already demonstrated an impressive knowledge of current and potential funding sources and have begun making connections that will aid the proposed program both in terms of funding and professional connections in the near future. Central to their proposal, however, is the need for faculty support as the program grows.

As I understand it, this proposal includes the need for funding for an adjunct position in its second year, and then a new tenure-track faculty line once the program has become more established with a full body of students in its fourth year. This additional line will be important for the proposed program in order for it to support and train its students. Not only will the additional line be required to support the program's teaching efforts, but to provide the quantity and variety of opportunities for research that will be needed by its students. I would strongly encourage the College to grant this position by the proposed program's fourth year.

8. Evaluate credentials and involvement of **adjunct faculty** and **support personnel**.

There are presently three adjunct faculty teaching the laboratory components of introductory physics courses. I expect this will remain necessary as the program grows. Eventually, as current faculty, who presently teach all introductory lecture sections, are required to teach upper division courses, the number of adjunct faculty will have to increase by one or two to cover introductory courses. Eventually, I presume, the number of adjuncts will decrease when a new full-time tenure-track position is in place. Should the need for adjunct faculty increase, I am confident that the need could be met given the market for qualified educators in the area of Old Westbury.

III. Students

9. Comment on the **student population the program seeks to serve**, and assess plans and projections for student recruitment and enrollment.

On the surface, Physics programs exist to serve students whose interest lies in studying the fundamental mechanisms by which the universe works. Some students are attracted to physics because of the other avenues of study which physics allows them to explore. The proposed program blazes paths for students into the fields of finance, medicine, computation, laboratory science, and many other fields through their proposed concentrations. It will also help with retention. I was told that one of the main reasons students leave Old Westbury is to pursue degree programs elsewhere that are not offered there. The new Physics program will serve as a tool for student retention by providing more avenues of students who are undecided in what they want to study or who decide to change their focus after they arrive at College.

SUNY College at Old Westbury has made it part of its core mission to educate traditionally underserved communities. Over half of its population identifies as African American or Hispanic/Latino. The proposed Physics program is designed with service to these students in mind. This is especially important because those populations are typically underrepresented in the hard sciences.

The faculty and administration I have spoken with are not only dedicated to drawing on a diverse student population for the proposed program but have demonstrated planning and forethought into how to do so. These plans include use of internal programs and outreach to the community. The CSTEP program is an invaluable resource in this regard and I am pleased that the faculty have thought about how best to use it to their advantage in recruiting and supporting the work of underrepresented populations in Physics.

The current proposal includes a projection for student enrollment that I believe is achievable and sustainable. The numbers are in line with schools of similar size and student population. It is worth noting that, in traditionally small programs such as Physics, variance in enrollment can lead to years where the number of physics majors is small, sometimes for a couple of years in a row. However, as pointed out to my by Provost Duncan Quarless, one of the strengths of the proposed concentrations is the potential to draw students from other majors such as Business and Mathematics into upper level courses in the proposed Physics program, thus supporting class size numbers beyond the number of physics majors.

10. What are the prospects that recruitment efforts and admissions criteria will supply **a sufficient pool of highly qualified applicants and enrollees**?

I do not believe SUNY College at Old Westbury will have any trouble meeting the proposed enrollment projections, especially given the attractiveness of the proposed concentrations, location of the institution, and opportunities for internal support. The College has seen impressive growth over the past decade, and the rate of growth in STEM majors is much larger than that of the College's average. Despite that, there are currently only a few program offerings in STEM.

The proposed program faculty are enthusiastic about engaging in outreach in the local community and beyond, which will be important for recruitment. In my conversations with them and from what I can tell from the students with whom I interacted, the student population is dedicated to their work and on the whole very talented. The faculty have been taking advantage of this by involving students in interesting and engaging research projects already, which will also be a benefit to future recruitment efforts. Their impressive pool of Physics minors is a testament to the promise of their recruiting efforts, which I expect will complement the wider efforts undertaken by the College's Office of Public and Media Relations.

11. Comment on provisions for encouraging participation of **persons from underrepresented groups**. Is there

adequate attention to the needs of part-time, minority, or disadvantaged students?

As mentioned previously, SUNY College at Cold Westbury has as part of its guiding doctrine a mission to recruit and serve underrepresented groups. The diversity of its student body is a testament to that mission. The current program is designed to serve these populations specifically, for instance through strategic use of the CSTEP program. The current faculty have been and intent to continue to utilize CSTEP for recruitment, support for summer student involvement, research, and mentorship. The program is also being designed with the goal in mind of becoming a pipeline of well-trained, talented students from underrepresented populations to several sectors of industry which are eager to support a more diverse workforce.

12. Assess the system for monitoring **students' progress and performance** and for **advising students** regarding academic and career matters.

The faculty take advising students very seriously, which is encouraging as this is an often overlooked aspect in the design of new academic programs. Students across concentrations within Physics take a common set of core courses in their first years. Careful advising after that point will allow students to choose a concentration based on their interests and ability. The requirement that all students in the proposed major will have to complete a capstone research project will also keep students in regular contact with faculty. I would advise the faculty to carefully assess the progress of each of their students by the end of their first year and in regular semesterly intervals, both to guide their progress and to catch students early on who may not be able to complete upper level course requirements.

13. Discuss prospects for graduates' post-completion success, whether **employment, job advancement, future study, or other outcomes related to the program's goals.**

Successful Physics majors are highly employable, and as mentioned earlier in this report in section 5, an overall 95% of physics majors are in graduate programs or are employed within one year of graduation. Given the talent and ambition of the proposed program faculty, I am confident in the quality of education and resulting knowledge and technical skill of this program's future graduates. Given national statistics for well-trained physics students, along with the proposed concentrations, a diverse student population, and the advantages of Old Westbury's geographic location, I have no doubt that the future graduates of this program will be employable and successful.

IV. Resources

14. Comment on the adequacy of physical **resources** and **facilities**, e.g., library, computer, and laboratory facilities; practical and internship sites or other experiential learning opportunities, such as co-ops or service learning; and support services for the program, including use of resources outside the institution.

As I understand it, there is a plan in place to refurbish an old science building at Old Westbury into a space designed in part for the specific use of this proposed new program. The refurbished building will include teaching, laboratory, research, and seminar space specifically designed to cater to the unique needs of the proposed program. The plans as shown and described to me by several people seem ideally suited to the needs of the proposed Physics program and also account for the expected expansion in student needs and faculty research space. The planned seminar and computing space seems impressive as well. The faculty tell me they plan on using the space to host and engage with potential collaborators in both industry and academia, which I would highly encourage.

The faculty came to our discussions well prepared to court nearby institutions, companies, and government agencies in pursuit of educational and experiential partnerships for the benefit of their students. These include research partnerships with institutions such as SUNY Stony Brook and Brookhaven National Laboratory, and industry partnerships with financial institutions and research groups. I expect that professional relationships of both kinds could lead to financial support for students and student-involved research.

15. What is the **institution's commitment** to the program as demonstrated by the operating budget, faculty salaries, the number of faculty lines relative to student numbers and workload, and discussions about administrative support with faculty and administrators?

The proposal has laid out a projected need for additional adjunct faculty in the first few years, and eventually a new tenure-track position in or about its fourth year. I am confident given my conversations with administration that the needed adjunct support would be provided and the expected need for a tenure-track line could be met assuming the program's enrollment goals are being met. It is worth reiterating that if the program's enrollment goals are met, an additional tenure-track faculty line will be critical to the continued success of the program and its students.

In terms of support for operating budget, I understand that a significant part of the cost of buying equipment to furnish introductory labs and research spaces will be folded into refurbishment of the science building. At the time that I write this, the additional costs given in the current proposal include $25,000 for expanding advanced teaching lab needs as the program ushers more students into their third and fourth year. I have advised the faculty to investigate the probable cost for furnishing a set of advanced lab setups, as I expect it may exceed this estimate.

Scientific equipment often incurs infrequent but significant one-time costs, for instance when an expensive part breaks in a ten-year-old piece of equipment. I was encouraged that these costs could be handled by both faculty and administration. There seems to be good and reasonable sharing of resources at the departmental level.

V. Summary Comments and Additional Observations

16. Summarize the **major strengths and weaknesses** of the program as proposed with particular attention to feasibility of implementation and appropriateness of objectives for the degree offered.

The major strengths of the proposed Physics program include the strength and ambition of its faculty, the strength of administrative support, facilities, and attractiveness of proposed concentrations.

- The program faculty not only have a track record of excellent teaching and scholarship, but in every aspect of the design and implementation of this program have shown dedication and enthusiasm.
- Equally important is a very supportive administration who, at all levels, are excited about the proposed program and clear about what will be needed to support it, especially in its early years.
- The refurbishment of an old building which will provide facilities for the proposed program is especially encouraging for the future of the program as it has been designed with purpose-specific teaching and research spaces.
- One of the strongest aspects of the program is the proposed concentrations, which I believe will attract both students who would be attracted to a traditional physics program as well as those looking for something more unique in the financial or medical fields.

The potential weaknesses of the program include uncertainty in recruitment early on, the relative inflexibility of student schedules when upper-division courses are offered biennially, and the need to create partnerships with other institutions.

- Recruitment for majors in the first few years of any new program carries with it significant inherent uncertainty, and this can be especially problematic for programs which traditionally enroll relatively few majors overall. However, given the planning and drive of the program faculty, I am confident that all reasonable efforts will be made to recruit and retain students early on and in the future.
- My understanding is that certain upper-division courses required for most of the concentrations within the physics major will be offered biennially, a practice common to physics programs at medium and small schools including my own. One problem that sometimes arises as a result is that some students, for one reason or another, will wind up not being able to take one of these biennial courses in their normal four year course of study. In those cases, perhaps other courses may be substituted at the discretion of the program, the course may be taken at another school, or the student may be able to make up the course through an independent study. The program must be prepared to deal with these cases which, while rare, I believe will be inevitable.
- Also common in physics programs in small to medium sized schools, there is great benefit in creating research partnerships with nearby companies and institutions. Doing so effectively expands on opportunities for students to do research, engage in internships, and connect to other bodies of students.

17. If applicable, particularly for graduate programs, comment on the ways that this program will make a **unique contribution** to the field, and its likelihood of achieving State, regional and/or national **prominence**.

As I have mentioned previously, but cannot overstate, the Health Science and Quantitative Finance concentrations make this program truly stand out. The program's access and commitment to traditionally underserved populations, thanks in no small part to Old Westbury's mission to recruit and serve those populations, also contributes to its uniqueness and value.

18. Include any **further observations** important to the evaluation of this program proposal and provide any **recommendations** for the proposed program.

The strongest recommendation I can make is to emphasize recruitment early. This can be accomplished through traditional methods such as paper and electronic mailings and visits to local high schools, but I would suggest the faculty cultivate an engaging social media presence as well, especially on platforms popular to young people such as Instagram, Snapchat, and TikTok (use of Twitter and Facebook by teens has fallen off precipitously in recent years, https://www.statista.com/statistics/250172/social-network-usage-of-us-teens-and-young-adults/). Beyond that, I am encouraged that the faculty already have great ideas for how they can craft and maintain industry and research partnerships. I strongly encourage them to pursue those partnerships wherever possible.

In summary of the recommendations I have made elsewhere in this document, I would encourage the program to develop a Physics Education concentration after a few years once the program is operating in a steady state. I understand that this is a complicated process and should wait for now..

I feel that my evaluation of the program in this document has been comprehensive. My overall feeling is that the proposal for a new physics major program is very strong. I am confident that students who go through the program will come out well trained and ready for either graduate school or the job market. The proposed program has the potential to make a significant positive impact on SUNY College at Old Westbury, its students, and community.

SUNY The State University of New York

External Reviewer Conflict of Interest Statement

I am providing an external review of the application submitted to the State University of New York by:

SUNY at Old Westbury

(Name of Institution or Applicant)

The application is for (circle A **or** B below)

A) New Degree Authority

B) Registration of a new academic program by an existing institution of higher education:

B.S. in Physics

(Title of Proposed Program)

I affirm that I:

1. am not a present or former employee, student, member of the governing board, owner or shareholder of, or consultant to the institution that is seeking approval for the proposed program or the entity seeking approval for new degree authority, and that I did not consult on, or help to develop, the application;

2. am not a spouse, parent, child, or sibling of any of the individuals listed above;

3. am not seeking or being sought for employment or other relationship with the institution/entity submitting the application?

4. do not have now, nor have had in the past, a relationship with the institution/entity submitting the application that might compromise my objectivity.

Name of External Reviewer (please print):

Neil Aaronson

Signature:

APPENDIX 7

Institutional Response to External Evaluation Reports (Section 8)

SECTION 8 - Institutional Response to External Evaluator Reports

In Spring 2021, two external evaluators evaluated SUNY Old Westbury in view of the proposal for the Bachelor of Science in Physics, with General Physics, Health Science, Quantitative Finance, and Applied/Computational Concentrations.

- Dr. Magee is a Professor of Physics at The College of New Jersey, 2007-present. He teaches a large variety of courses ranging from lower division courses to upper division courses, as well as courses in independent research. Dr. Magee has an extensive publication record in peer-reviewed journals in topics ranging from climatology to physics education. He has a large amount of experience in mentoring students and attracting funding for physics education research.
- Dr. Aaronson is a Professor of Physics at Stockton University, 2018-present. Dr. Aaronson teaches both lower and upper division physics courses and some specialty courses he designed on sound and hearing. He has a strong publication and conference presentation record.

Due to COVID-19 restrictions, the evaluation was held remotely. Throughout the end of March and beginning of April, the evaluators met independently with the provost, dean, faculty, the Chemistry and Physics chair, the chairs of the Math, Biology and Business departments, as well as students currently minoring in physics.

External Evaluator:		**Nathan Magee**	
3/25			
10:15 AM	10:30 AM	Set-up and introductions	John Estes, Michael Kavic, Matthew Lippert
10:30 PM	11:20 PM	Meeting with faculty	Michael Colaneri, Fernando Espinoza, John Estes, Michael Kavic, Matthew Lippert
11:30 AM	11:55 AM	Meeting with concentration chairs	Albert Murphy (Management, Marketing & Finance), Manya Mascareno (Biology), Frank Sanacory (Math/CIS)
12:00 PM	12:25 PM	Meeting with Chemistry/Physics department chair	Lori Zaikowski
4/1			
1:00 PM	1:25 PM	Dean	Amanda Frisken
2:00 PM	2:25 PM	Meeting with students	
2:30 PM	2:45 PM	Facilities overview and wrap-up	John Estes, Michael Kavic, Matthew Lippert
4/5			
10:30 AM	11:00 AM	Provost	Duncan Quarless
External Evaluator:		**Neil Aaronson**	
3/26			
1:15 PM	1:30 PM	Set-up and introductions	John Estes, Michael Kavic, Matthew Lippert
1:30 PM	1:55 PM	Meeting with Chemistry/Physics department chair	Lori Zaikowski
2:00 PM	2:25 PM	Meeting with concentration chairs	Albert Murphy (Management, Marketing & Finance), Manya Mascareno (Biology), Frank Sanacory (Math/CIS)
2:30 PM	3:25 PM	Meeting with faculty	Michael Colaneri, Fernando Espinoza, John Estes, Michael Kavic, Matthew Lippert
4/2			

1:00 PM	1:25 PM	Dean	Amanda Frisken
2:00 PM	2:25 PM	Meeting with students	
2:30 PM	2:45 PM	Facilities overview and wrap-up	John Estes, Michael Kavic, Matthew Lippert
4/5			
1:00 PM	1:25 PM	Provost	Duncan Quarless

In Dr. Magee's summary he comments:

> *In my view, the proposal lays out a compelling and well-crafted B.S. program in physics. Careful attention has been paid to ensuring that a rigorous and inclusive curriculum can be offered to students in a manner that makes it feasible for students to complete, and also feasible for faculty and the institution to offer.*

In Dr. Aaronson's summary he comments:

> *As I have mentioned previously, but cannot overstate, the Health Science and Quantitative Finance concentrations make this program truly stand out. The program's access and commitment to traditionally underserved populations, thanks in no small part to Old Westbury's mission to recruit and serve those populations, also contributes to its uniqueness and value.*

These views are further reflected by both authors throughout their evaluations. We concur with both opinions; the physics major was designed to be both flexible and efficient.

Magee:

> *The proposed gradual roll-out of the new program is calibrated to avoid unnecessary costs or risks to the institution. The proposal makes a convincing case that existing resources and infrastructure are sufficient to start the program on a good path, and that moderate investments at years 3-5 can be made in sync with the actual growth of the program.*

Giving students a choice of strong regional career paths is at the forefront of the design of the physics program. The physics program was created with four different concentrations designed to both fill gaps in Old Westbury's course offerings and to take advantage of employment sectors in New York and Long Island.

Magee:

> *The proposal describes a carefully-crafted plan to offer several interdisciplinary degree concentrations in areas of physics that are particularly relevant to the interests of Old Westbury students and faculty, and are also aligned with fields that have strong regional career opportunities for graduates.*

Aaronson:

The most unique and interesting aspect of the proposed physics program, which I feel would make it distinct from many physics programs not just in the region but across the country, is the proposed concentrations. The General Physics and Applied/Computational concentrations are typical for most physics programs that wish to prepare their students for graduate studies or jobs in industry. … Health Science concentrations within Physics programs are quite rare. They give students the opportunity to prepare for careers in medical imaging, nuclear medicine, and other medical disciplines. This kind of preparation is becoming more important as the medical field is becoming more technical and computerized. … For the past few decades, Wall Street has been keen to recruit physics students to make use of their quantitative skills, especially students with experience in numerical modeling and simulation of chaotic systems. … Creating a degree concentration that specifically prepares physics students for careers in finance and economics is a good tactic both for recruiting potential students and for ensuring student success after graduation, particularly for a school so close to Manhattan.

The program addresses needs at the university, state and national levels.

Aaronson:

The College has seen impressive growth over the past decade, and the rate of growth in STEM majors is much larger than that of the College's average. Despite that, there are currently only a few program offerings in STEM.

Magee:

As mentioned above, the proposed concentrations in Health Sciences and Quantitative Finance are particularly unique designs that are well-attuned to regional job opportunities on Long Island and in New York City.

Magee:

As an institution, SUNY Old Westbury is highly invested in providing outstanding educational opportunities to underrepresented minority groups (URM). This is not just a talking point -- more than 50% of Old Westbury students meet URM criteria, including nearly 60% of students in existing STEM majors. My interviews with physics faculty and college administrators clearly indicated that they are attuned to providing careful consideration and attention to support the success of these students. As a discipline, physics has one of the lowest rates of URM participation nationally (~13% of Physics B.S. degrees), so this new program therefore has great potential to make an important impact in this critical area.

Both evaluators mention the lack of a physics teaching concentration as a drawback. Once the Physics program is running, we intend to work with Old Westbury's School of Education to develop a physics

education program. This was communicated to the evaluators during the evaluation.

Magee:

> *At first, the omission of a physics teaching concentration looks like a potential missed opportunity. In talking to faculty and administrators, it seems clear that they recognize this as a potential area for growth once the program is successfully established. Given the additional requirements for accreditation and certification of new teacher preparation programs, it does make good sense to revisit this growth opportunity in several years.*

Another possible weakness they identify is student recruitment. Enrollment in physics programs for schools our size has a large variation nationwide. We have taken steps to account for both undershooting and overshooting our enrollment targets. This is recognized by both evaluators.

Magee:

> *The projected enrollment is subject to considerable uncertainty, especially given the volatile collegiate enrollment environment associated with the Covid-19 pandemic. I think that both of these potential concerns would be true of most new programs, and in this case are addressed successfully by limiting the need for investments until growing enrollments are demonstrated.*

Aaronson:

> *Recruitment for majors in the first few years of any new program carries with it significant inherent uncertainty, and this can be especially problematic for programs which traditionally enroll relatively few majors overall. However, given the planning and drive of the program faculty, I am confident that all reasonable efforts will be made to recruit and retain students early on and in the future.*

Both evaluations expressed views that current facilities would be able to support the physics program, with the only concerns stemming from large growth in enrollment and development of the new upper division laboratory course.

Magee:

> *The chemistry and physics department currently shares administrative and lab support personnel. This current arrangement should continue to function adequately in the short-to-medium term. If the program grows to the extent that 10+ graduates are completing the program each year and one or two new full-time faculty are needed, then an additional support person or adjusted administrative structure may need to be considered.*

Aaronson:

> *At the time that I write this, the additional costs given in the current proposal include $25,000 for expanding advanced teaching lab needs as the program ushers more students into their third*

and fourth year. I have advised the faculty to investigate the probable cost for furnishing a set of advanced lab setups, as I expect it may exceed this estimate.

SUNY Old Westbury has already accommodated a large constant growth in student enrollment in the physical and life sciences over the past ten years. If this growth continues, an additional laboratory technician specializing in physics will eventually be hired. We have also considered Dr. Aaronson's comment regarding the cost of the upper division labs and performed a more detailed cost analysis. The proposal includes an updated cost, implemented in a way that the additional cost is contingent on enrollment targets being met.

In summary, as per our external evaluators, the structure and design of the program are well-crafted and the curricular structure is in accord with other physics programs around the nation. Physics is a core science program and the strong growth in STEM enrollment demands the establishment of such a program at Old Westbury. Given the lack of diversity in physics at a national level and the strong diversity of Old Westbury, there is no reason why Old Westbury should be one of the very few comprehensive campuses in SUNY without a physics program.