ACADEMIC AFFAIRS
STEVENSON
UNIVERSITY
Executive Vice President

1525 Greenspring Valley Road
Stevenson, Maryland 21153

18 September 2018

James D. Fielder, Jr., Ph.D.
Secretary of Higher Education
Maryland Higher Education Commission
6 N. Liberty Street, 10th Floor
Baltimore, Maryland 21201

Dear Dr. Fielder:

On behalf of President Elliot Hirshman and Stevenson University, I am pleased to submit the enclosed proposal to add a Bachelor of Science degree program in **Biomedical Engineering**. The proposal has been approved by all of the necessary internal constituencies at Stevenson University, including the Deans' Council, the Faculty Council, President Elliot Hirshman, and our Board of Trustees.

In compliance with MHEC's request, we are submitting this cover letter and the proposal as PDF attachments to an e-mail message. We have also submitted under separate cover the required filing fee in accordance with MHEC procedures.

Please contact me at 443-334-2205 or at sgorman@stevenson.edu if you have questions. Thank you for consideration of our proposal.

Sincerely,

Susan Thompson Gorman, Ph.D.
Executive Vice President and Provost
Office of Academic Affairs
Stevenson University
443-334-2205
sgorman@stevenson.edu

Office Use Only: PP#

MHEC
Creating a state of achievement

Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	Stevenson University

Each action below requires a separate proposal and cover sheet.

- ◉ New Academic Program New
- ○ Area of Concentration New
- ○ Degree Level Approval New
- ○ Stand-Alone Certificate
- ○ Off Campus Program
- ○ Substantial Change to a Degree Program
- ○ Substantial Change to an Area of Concentration
- ○ Substantial Change to a Certificate Program
- ○ Cooperative Degree Program
- ○ Offer Program at Regional Higher Education Center

Department Proposing Program	School of the Sciences	
Degree Level and Degree Type	Bachelor of Science	
Title of Proposed Program	Biomedical Engineering	
Total Number of Credits	120	
Suggested Codes	HEGIS: 905	CIP: 140501
Program Modality	◉ On-campus ○ Distance Education (*fully online*) ○ Both	
Program Resources	◉ Using Existing Resources ○ Requiring New Resources	
Projected Implementation Date	◉ Fall ○ Spring ○ Summer	Year: 2020
Provide Link to Most Recent Academic Catalog	URL: http://www.stevenson.edu/academics/catalog/	
Preferred Contact for this Proposal	Name: Susan Gorman, Ph.D.	
	Title: EVP Academic Affairs & Provost	
	Phone: (443) 334-2205	
	Email: sgorman@stevenson.edu	
President/Chief Executive	Type Name: Elliot Hirshman, Ph.D.	
	Signature: Elliot Hirshman	Date: 7/18/18
Approval/Endorsement by Governing Board	Type Name: Not required by COMAR	
	Signature:	Date:

Revised 5/15/18

Stevenson University
Beverly K. Fine School of the Sciences
Proposal for a New Academic Program
B.S. in Biomedical Engineering

A. Centrality to Institutional Mission and Planning Priorities:

Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.

Program Description

Stevenson University is proposing a new Bachelor of Science (B.S.) in Biomedical Engineering. The program emphasizes critical and creative thinking in addition to technical skills and knowledge and provides students with opportunities to apply these skills and knowledge to the solution of real world problems. A strong foundation in basic sciences and math, including biology, chemistry, physics, and data analysis, coupled with specific biomedical engineering coursework provides students with a broad interdisciplinary background. Teamwork is integrated throughout the program, enabling students to develop relational skills valued by employers, and internship and research opportunities facilitate a deep, practical exploration of the biomedical engineering field. Graduates of this program will be creative problem solvers prepared to meet the challenges of an ever-changing world in a variety of scientific fields, including basic and applied research, product development, medicine, and others.

Relationship to the Institution's Approved Mission

"Stevenson University is an innovative, coeducational, independent institution offering undergraduate and graduate students a career-focused education marked by individualized attention, civility, and respect for difference. The University blends the liberal arts with career exploration and planning, complementing a traditional education with applied learning beyond the classroom. The University meets students where they are and supports and challenges them to become reflective and accomplished individuals committed to a lifetime of learning and contribution. Students graduate with the competence and confidence needed to address creatively the opportunities and problems facing their communities, the nation, and the world."

As an applied science, the proposed Bachelor of Science program in Biomedical Engineering has a strong relationship to Stevenson University's career-focused mission. Required internship and capstone experiences encourage students to explore career paths and apply the knowledge and skills learned in their coursework to situations outside the traditional classroom. Students demonstrate respect and appreciation for differences as they engage in creative problem-solving and work in teams throughout the program. In addition, the program aligns well with the mission of the Beverly K. Fine School of the Sciences to "**Prepare** mathematically and scientifically literate professionals to take on challenges in our rapidly changing world; **Inspire** collaboration and critical thinking to solve problems; and **Engage** in innovative approaches to make math and science accessible."

Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.

The proposed Biomedical Engineering degree is directly aligned with the University's strategic goals and is an institutional priority. The program has received the full support of all stakeholders, including, but not limited to, the Faculty Council, Deans' Council, Provost, President, and the Academic Affairs Committee of the Board of Trustees.

In the 2014-2019 Strategic Plan for Stevenson University, approved by the Board of Trustees in September 2014, the following four strategies are outlined:

Academic Affairs
The University will support faculty and students in their pursuit of academic excellence by integrating academics with experiential learning and career preparation, and by establishing a solid liberal arts foundation.

University
Stevenson is an innovative institution of higher education that will fulfill its mission, advance its vision, and integrate its values with the engaged support of its faculty, staff, students and others.

Student Life
The University will engage its community in creative, intellectual, social and athletic experiences, and it will foster a campus climate characterized by intellectual rigor, wellness, diversity, civility, and environmental consciousness, as well as self-awareness and national and global awareness.

Financial Resources
The University will enhance its financial resources increasing revenues, aligning costs with strategic initiatives, identifying additional opportunities, and responding effectively to any associated challenges.

This program aligns with the Academic Affairs strategy to "support faculty and students in their pursuit of academic excellence by integrating academics with experiential learning and career preparation, and by establishing a solid liberal arts foundation." The program builds on the University's existing strengths in the sciences and mathematics and complements the liberal arts foundation provided by the Stevenson Educational Experience (SEE) general education curriculum with experiential learning and career exploration. Further, the program has been identified as an institutional priority in the *2018-2019 Stevenson University Initiatives*.

Provide a brief narrative of how the program will be adequately funded for at least the first five years of program implementation.

Half of the courses included in the curriculum for the B.S. in Biomedical Engineering already exist in the Fine School of the Sciences. In addition, the school moved into new facilities in 2016

which tripled laboratory instructional space, including laboratories with flexible furniture configurations. Several of these laboratories are reserved for future use, such as new academic programs. Thus, only a relatively small investment in course development and infrastructure will be needed. Some expenses will be incurred for equipment and staffing in order to establish the B.S. in Biomedical Engineering, as detailed in Section L. These start-up expenses will be staggered over a planning year and the first two years of student enrollment in the program. In subsequent years, expenses related to instructional supplies will be supported by the Laboratory Services unit within the Fine School of the Sciences and other expenses will be included in the program budget.

Provide a description of the institution's commitment to:

(a) ongoing administrative, financial and technical support of the proposed program
The proposed program will be housed in the Beverly K. Fine School of the Sciences. A Program Coordinator reporting to the Dean will be hired during the planning year in order to lead the development of program-specific courses and the acquisition of needed equipment, as well as contribute to the ongoing administrative, financial and technical support of the program.

(b) continuation of the program for a period of time sufficient to allow enrolled students to complete the program
Stevenson University fully anticipates continuation of this degree program beyond the time needed for students to complete. The University is committed to the success of its undergraduate students and provides various support services to ensure timely progression and completion, including dedicated Student Success Coaches for incoming freshmen, program-specific academic advisors for upper level students, and a variety of academic support programs including tutoring, Peer-Assisted Learning, and specialized academic support in science and math courses.

B. Critical and Compelling Regional or Statewide Need as Identified in the Statewide Plan
The proposed B.S. in Biomedical Engineering program aligns with several strategies identified for supporting student success in *2017-2021 Maryland State Plan for Postsecondary Education: Increasing Student Success with Less Debt*. As an applied STEM degree, the program is responding to workforce needs in developing graduates' critical thinking, problem-solving, and communication skills.[1] In addition, all academic programs at Stevenson University integrate at least one internship experience and connect career planning to the academic experience through coursework and advising. This approach will also be applied to the Biomedical Engineering program, thus supporting Strategy 7 to enhance career advising and planning, integrate it into academic advising and increase internship opportunities.[2]

[1] Maryland Higher Education Commission, *2017-2021 Maryland State Plan for Postsecondary Education: Increasing Student Success with Less Debt*, (2017), p.51.
[2] Maryland Higher Education Commission, *2017-2021 Maryland State Plan for Postsecondary Education: Increasing Student Success with Less Debt*, (2017), p.60.

Stevenson University's association with Project Lead the Way (PLTW), a national provider of high quality K-12 STEM curricula, presents a unique mechanism by which this program will also support Strategy 1 in the State Plan. As a partner with PLTW, Stevenson University offers college credit to high school students who complete the PLTW Biomedical Sciences program and meet certain eligibility criteria.[3] The Biomedical Engineering program will also offer similar credit, facilitating the alignment of the program with the PLTW Biomedical Sciences and pre-Engineering programs (both considered CTE programs in Maryland) and offering early access to college credit for high school students.[4]

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State

Describe potential industry or industries, employment opportunities, and expected level of entry for graduates of the proposed program.

Biomedical engineers work in a variety of industries, including, but not limited to, manufacturing, healthcare, research, and product development. The interdisciplinary nature of the field bridges the gap between medical researchers/scientists and manufacturers. Particularly as the population ages, there will be higher demand for the development and refinement of new biomedical procedures and devices.[5] Biomedical engineers play a key role in the research, design, and manufacture of these advances. Based on analysis of current job postings in the State of Maryland and regionally, the majority of employment openings in biomedical or bioengineering are at the bachelor's level, indicating that graduates of this program will be well-positioned for employment.[6]

Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program. Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies over the next five years.

According to the Bureau of Labor Statistics, national demand for biomedical engineers (SOC 17-2031) is projected to increase by 7.2% from 2016-2026, with an estimated increase of 1500 new openings and an annual average of 1600 openings.[7] In addition, the state of Maryland is ranked in the top five in the concentration of positions for biomedical engineers and the Silver Spring-Frederick-Rockville Metropolitan Area is ranked in the top ten areas in the employment level of

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[3] Stevenson University website, www.stevenson.edu/pltw, "Earn College Credit" (2018).
[4] Maryland Higher Education Commission, *2017-2021 Maryland State Plan for Postsecondary Education: Increasing Student Success with Less Debt*, (2017), p.33.
[5] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook Biomedical Engineers*, https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm, accessed 01 August 2018.
[6] Hanover Research, *Market Analysis: BS in Biomedical Engineering Prepared for Stevenson University* (July 2018), p.5.
[7] Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook Biomedical Engineers*, https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm, accessed 01 August 2018.

biomedical engineers. The projected demand for biomedical engineers in the state of Maryland is shown in Table 1 below.

Table 1. Maryland Labor Projections 2016-2026[8]

Occupation Code	Occupation Title	Employment		% change	Available jobs/candidate
		2016	**2026**		
17-2031	Biomedical Engineer	668	699	4.64%	3.33

The 10-year employment outlook for biomedical engineers in the Mid-Atlantic region (including District of Columbia, Maryland, New Jersey, New York, North Carolina, Pennsylvania and Virginia) is similarly positive with projected increases in the individual states ranging between 4.5%-20% and projected total new annual openings of 280.[9] Graduates of a program with the proposed CIP code (14.0501) may also enter related occupations in the life sciences (with or without further education), including Biochemists/Biophysicists (SOC 19-1021) or Bioscientists (SOC 19-1029). If these related occupations are also considered, the statewide demand remains strong, with projected increases in employment of 8.62% and 2.0%, respectively.[10]

Interest in undergraduate engineering programs is also strong. Of 2017 high school graduates who took the SAT in high school, 11% reported engineering as their intended major nationally (over 150,000 students)[11] and in the state of Maryland (over 4,000 students)[12], second only to Health Professions/Related Clinical Sciences. According to the Maryland Higher Education Commission Academic Program Inventory, eight institutions in the state of Maryland offer a bachelor's degree in one or more engineering disciplines.[13] Of those, only Johns Hopkins University and University of Maryland College Park offer a bachelor's degree in the same CIP code (14.0501) as the proposed program, though other similar programs at all degree levels exist (Table 2).

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[8] Maryland Workforce Exchange, *Occupational Projections (Long-Term) for Biomedical Engineers in Maryland 2016-2026*, https://mwejobs.maryland.gov/vosnet/analyzer/results.aspx?session=occproj, accessed 01 August 2018.

[9] Projections Management Partnership, Projections Central State Occupational Projections: Long-Term Projections, http://www.projectionscentral.com/Projections/LongTerm, accessed 01 August 2018.

[10] Maryland Workforce Exchange, *Occupational Projections (Long-Term) in Maryland 2016-2026, https://mwejobs.maryland.gov/vosnet/analyzer/results.aspx?enc=EPXWjEv0SO+8zdwCS+6+lQ==*, accessed 15 August 2018.

[11] College Board, *SAT Suite of Assessments Annual Report – Total Group*, https://reports.collegeboard.org/pdf/2017-total-group-sat-suite-assessments-annual-report.pdf, accessed 01 August 2018.

[12] College Board, *SAT Suite of Assessments Annual Report – Maryland*, https://reports.collegeboard.org/pdf/2017-maryland-sat-suite-assessments-annual-report.pdf, accessed 01 August 2018.

[13] Maryland Higher Education Commission, *Academic Program Inventory*, http://www.mhec.state.md.us/institutions_training/Pages/HEPrograms.aspx, accessed 01 August 2018.

Table 2. Biomedical Engineering and Related Degree Programs in Maryland

Program Name	Degree(s) Offered	Institution
CIP Code 140301 (Agricultural/Biological Engineering and Bioengineering)		
Bioengineering	Bachelor's	University of Maryland College Park
Biological Resources Engineering	Master's	University of Maryland College Park
CIP Code 140501 Biomedical/Medical Engineering		
Bioengineering	Bachelor's/Doctorate	University of Maryland College Park
Biomedical Engineering	Bachelor's/Master's/Doctorate	Johns Hopkins University
Applied Biomedical Engineering	Master's/Post-Master's Certificate	Johns Hopkins University
Bioengineering Innovation & Design	Master's	Johns Hopkins University
CIP Code 140701 Chemical Engineering		
Chemical & Biomolecular Engineering	Bachelor's/Master's/Doctorate	Johns Hopkins University
Chemical & Biochemical Engineering	Master's/Doctorate	University of Maryland Baltimore County

Provide data showing the current and projected supply of prospective graduates.

The supply of graduates in biomedical engineering and bioengineering in Maryland has declined slightly in the last two years and is less than the estimated and projected number of employment openings for 2016-2026 (Table 3).

Table 3. Number of Graduates in Biomedical Engineering

Institution	Number of Graduates (2015-2016)[14]	Number of Graduates (2016-2017)[15]	Estimated Employment Openings (2016)	Projected Employment Openings (2026)
Johns Hopkins University	123	103	668	699
Univ. of Maryland College Park	104	94		
Total	**227**	**197**		

[14] Yoder, Brian. 2016. *Engineering by the Numbers, American Society for Engineering Education,* https://www.asee.org/documents/papers-and-publications/publications/college-profiles/16Profile-Front-Section.pdf, accessed 01 January 2018.

[15] Yoder, Brian. 2017. *Engineering by the Numbers, American Society for Engineering Education,* https://www.asee.org/documents/papers-and-publications/publications/college-profiles/2017-Engineering-by-Numbers-Engineering-Statistics.pdf, accessed 01 August 2018.

Table 4. Projected Enrollment in Proposed Program, 2020-2025

Program	Year 1 2020-2021	Year 2 2021-2022	Year 3 2022-2023	Year 4 2023-2024	Year 5 2024-2025
Biomedical Engineering	10	21	34	50	64

Table 5. Projected Graduates of Proposed Program, 2021-2026

Program	Year 1 2021-2022	Year 2 2022-2023	Year 3 2023-2024	Year 4 2024-2025	Year 5 2025-2026
Biomedical Engineering	0	0	5	8	10

The available evidence as summarized above indicates that demand is strong for undergraduate engineering programs in general. In addition, employment prospects for biomedical engineers are good in Maryland and surrounding states and the number of graduates in this specific engineering discipline, including the proposed program, is within the current and projected demand.

D. Reasonableness of Program Duplication

Identify similar programs in the State and/or same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded. Provide justification for the proposed program.

As described, only two bachelor's degree programs in the same CIP code (140501) exist in the State, at Johns Hopkins University and University of Maryland College Park. An additional related bachelor's degree program in Chemical & Biomolecular Engineering is also offered by Johns Hopkins University, but this program is classified in the Chemical Engineering CIP code (140701).

The existing programs at Johns Hopkins University and University of Maryland College Park are housed in schools of engineering. Both offer specific tracks or focus areas for specialization in fields related to computational biology, biological systems engineering, biomaterials, biomedical instrumentation, and others. The proposed program will be housed in the Beverly K. Fine School of the Sciences at Stevenson University and will be broadly focused with some opportunity to explore advanced topics through electives in both science and engineering. Unspecified general electives will also give students the flexibility to personalize their education by adding an academic or professional minor, participating in study abroad opportunities, or taking additional science and engineering courses. In keeping with Stevenson University's emphasis on career exploration and preparation, the proposed program will expose students to career options and provide opportunities for practical, applied problem-solving early in and throughout the curriculum. In addition, students will gain practical experience related to their specific career interests with the inclusion of a required credit-bearing internship experience and an immersive

capstone course which can be a research or internship experience. The liberal arts emphasis of the Stevenson Educational Experience (SEE) will reinforce interdisciplinary skills such as communication, creativity and collaboration. Graduates of this program will be well-prepared for employment as biomedical engineers and in other related basic science fields with strong technical skills and knowledge in a variety of scientific and mathematical disciplines, practical experience in specialized fields, and the ability to think critically and creatively as well as communicate effectively.

E. Relevance to High Demand Programs at Historically Black Institutions (HBIs)

Discuss the proposed program's potential impact on the implementation or maintenance of high demand programs at Historically Black Institutions (HBIs).

The proposed program is expected to have no impact on Maryland HBIs as there is no program duplication.

F. Relevance to the identity of Historically Black Institutions (HBIs)

Discuss the proposed program's potential impact on the uniqueness and institutional identities and missions of HBIs.

The proposed program is expected to have no impact on the uniqueness and institutional identities and missions of HBIs.

G. Adequacy of Curriculum Design, Program Modality and Related Learning Outcomes

Describe how the proposed program was established and also describe the faculty who will oversee the program.

Based on a desire to expand the portfolio of options available to Stevenson University students and to identify new academic programs that align with Stevenson University's career-focused mission, the university's president charged a small team of academic administrators and staff with conducting research on the feasibility of a biomedical engineering degree program. A market research firm, Hanover Research, was engaged in addition to the team conducting its own research on supply and demand, job market trends, and curriculum design. Recognizing that there are several well-established degree programs at various levels in many disciplines of engineering in the State, including a number at HBIs, the university administration determined that a biomedical engineering program would present the least amount of program duplication thus offering more opportunities for students to pursue an engineering field. The proposed curriculum was developed by the Fine School of the Sciences leadership using the Accreditation Board for Engineering Technology standards for biomedical engineering programs, the Stevenson Educational Experience outcomes, and an explicit career focus as guiding principles. Feedback on learning outcomes and the curriculum was sought from the faculty of the Fine School of the Sciences and the Faculty Council Academic Affairs Committee.

The B.S. in Biomedical Engineering will be overseen by a Program Coordinator who holds a terminal degree in biomedical engineering or a related engineering field. The University will conduct a search and hire this individual upon approval of the proposed program. The Program Coordinator will report to the Dean of the Beverly K. Fine School of the Sciences and will function as a member of the leadership team of the school. Responsibilities of the Program Coordinator include teaching in the program, development and oversight of the curriculum, assessment, and hiring, scheduling, evaluating, and developing faculty.

Describe educational objectives and learning outcomes appropriate to the rigor, breadth and (modality) of the program.

Educational Objective

The educational objective of the proposed program is to prepare biomedical engineers who work collaboratively to creatively solve problems and meet the challenges of a rapidly changing world. The program will prepare graduates to think critically, analyze data, and effectively communicate and work in teams to address biomedical issues.

Learning Outcomes

Upon successful completion of the Bachelor of Science in Biomedical Engineering, graduates will be able to:

1. Apply knowledge of mathematics, science, and engineering principles to the description and analysis of living systems.
2. Design and conduct experiments, including the analysis and interpretation of data.
3. Design a system, component, or process that meets desired needs within relevant constraints such as economic, environmental, ethical, safety, sustainability and others.
4. Collaborate effectively to formulate, test and refine an engineering solution to a biomedical problem or issue.
5. Evaluate scientific issues and findings using primary research literature.
6. Communicate scientific and engineering findings or conclusions in written and oral formats appropriate to the audience.
7. Conduct oneself in a manner consistent with the ethical and professional standards of the discipline.
8. Apply academic preparation to professional experiences outside the classroom.

Explain how the institution will:

(a) provide for assessment of student achievement of learning outcomes in the program. Assessment and documentation of student achievement of learning outcomes will occur according to school and institutional assessment processes. As part of the existing assessment, the level of achievement of each learning outcome will be defined in a program matrix for 100-, 200-, 300-, and 400-level courses in the program. Course-level learning objectives will be directly aligned to the program outcomes through the university's course proposal and approval process, ensuring that all course content supports the achievement

of program outcomes. Student achievement of program learning outcomes will be assessed on an annual basis, with a subset of program outcomes and/or courses being assessed on a rotating basis each year. The capstone course will additionally be assessed as part of the University's SEE general education assessment cycle, since it fulfills an upper-level writing intensive requirement. In addition, the program will seek accreditation by the Accreditation Board for Engineering and Technology (ABET) at an appropriate time.

(b) document student achievement of learning outcomes.

Student artifacts will be collected from specific courses at all levels of the program according to the established cycle of assessment. Artifacts will be evaluated to determine the level of student achievement of learning outcomes. Data will be analyzed and appropriate changes to the program will be made as needed based on the results.

Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements.

The courses listed below are required for completion of the B.S. in Biomedical Engineering. Students must also complete the Stevenson Educational Experience (SEE) general education requirements as outlined. Course descriptions for the program requirements are listed below the table.

Stevenson Educational Experience (SEE) – General Education Requirements	
ENG 151	3 credits
ENG 152	3 credits
CM Intensive	3 credits
Fine Arts	3 credits
Social Science Distribution (two different disciplines)	6 credits
Humanities Distribution (at least three different disciplines)	12 credits
Program Requirements **(Courses marked with an asterisk also fulfill SEE General Education Requirements)**	
FYS 100 First Year Seminar	1 credit
SCI 215 Writing in the Sciences*	3 credits; Fulfills 200-level Writing Intensive Requirement
BIO 113 General Biology I: Cell Biology and Genetics*	3 credits; Fulfills Scientific Reasoning Laboratory SEE Requirement (with BIO 113L)
BIO 113L General Biology I Laboratory*	1 credit
CHEM 115 General Chemistry I*	3 credits; Fulfills Scientific Reasoning Laboratory SEE Requirement (with CHEM 115L)
CHEM 115L General Chemistry I Laboratory*	1 credit
CHEM 116 General Chemistry II	3 credits
CHEM 116L General Chemistry II Laboratory	1 credit

MATH 220 Calculus I*	4 credits; Fulfills Quantitative Reasoning SEE Requirement
MATH 221 Calculus II	4 credits
MATH 222 Calculus III	4 credits
MATH 321 Differential Equations	4 credits
PHYS 215 General Physics I	4 credits
PHYS 216 General Physics II	4 credits
BME 101 Introduction to Biomedical Engineering	3 credits
BME 205 Problem Solving and Design	4 credits
BME 210 Thermodynamics	3 credits
BME 230 Biofluids	3 credits
BME 313 Biostatistics	3 credits
BME 315 Biomaterials	4 credits
BME 320 Biomedical Engineering Internship	3 credits
BME 335 Instrumentation	3 credits
BME 340 Systems Physiology	4 credits
BME 380 Biomechanics	4 credits
BME 450/455/460/465 Biomedical Engineering Capstone (choose one)*	5 credits or 9 credits; Fulfills Upper Level Writing Intensive SEE Requirement
Basic Science Electives (two courses), choose from: BIO 217 Principles of Biochemistry BIO 222 Human Anatomy BIO 230 Genetics BIO 310 Cell Biology BIO 322 Human Physiology BIO 330 Molecular Genetics BIOCH 327 Biochemistry BICH 427 Advanced Biochemistry CHEM 210 Organic Chemistry I/CHEM 210L Organic Chemistry I Laboratory CHEM 211 Organic Chemistry II/CHEM 211L Organic Chemistry II Laboratory CHEM 340 Medicinal and Drug Chemistry	6-8 credits
BME electives (two courses), choose from: BME 330 Bioelectric Systems BME 325 Transport Systems BME 365 Independent Research in Biomedical Engineering BME 425 Synthetic Biology	6 credits

Total number of credits for proposed degree = 120-125
General Education (SEE) credits, not including program requirements = 30 credits
Program Requirements, including SEE courses = 90-95 credits

Course Descriptions

BIO 113 General Biology I: Cell Biology and Genetics (3 credits; SR-L when taken with BIO 113L)
Emphasizes the molecular nature of biology and biological principles that are common to all life. Topics covered relate to the physical and biochemical structure and function of cells and cell processes and genetics.

BIO 113 General Biology I Laboratory: Cell Biology and Genetics (1 credit; SR-L when taken with BIO 113)
Introduces experimental methods and techniques used in the biology laboratory. Topics relate to cell structure and function, and skills covered include the scientific method and experimental design, microscope and micropipette use, and aseptic technique.

BIO 217 Principles of Biochemistry (3 credits)
Emphasizes the structure and function of carbohydrates, lipids, nucleic acids, amino acids and proteins in living systems. The properties of these biological molecules are related to their chemical structure and specific roles within the cell. Topics include membrane structure and function, enzyme mechanisms and kinetics, and the energetics of metabolic reactions and pathways. The theory of analytical methods used to study biological molecules is also covered.

BIO 222 Human Anatomy (4 credits)
Introduces the gross and microscopic structure of the human body. Topics include histology (cells and tissues) and the eleven systems of the body. Laboratories include microscopic examination of cells and tissues, as well as dissection and study and identification of gross anatomical features. Laboratory included.

BIO 230 Genetics (4 credits)
Examines the processes by which viruses, prokaryotes and eukaryotes transmit hereditary information. Topics include patterns of inheritance, probability, structure and replication of hereditary material, gametogenesis, gene expression and regulation, and mutation. Basic recombinant DNA technologies and their applications will also be discussed. Laboratory included.

BIO 310 Cell Biology (3 credits)
Describes the structure and function of prokaryotic and eukaryotic cells at the cellular and molecular levels, together with the methodology for their study. Emphasis is placed on organelles participating in cellular metabolism and energy transformations, communication, transport, movement, reproduction and inheritance.

BIO 322 Human Physiology (4 credits)
Explores the principles of human body function. Emphasis is on the mechanisms by which cells and organs perform their functions and the interactions of the various organs in maintaining homeostasis. Laboratory includes wet labs, computer simulations, interactive physiology

modules and an in-depth report and presentation by each student on a current topic in physiology or biomedical research. Laboratory included.

BIO 330 Molecular Genetics (4 credits)
Examines the processes by which viruses, prokaryotes and eukaryotes transmit hereditary information and regulate its expression. Topics include patterns of inheritance, structure and replication of hereditary material, transcription and its regulation, translation, mutation, recombinant DNA and oncogenes. Technology elucidating gene structure and function and the application of DNA technology to other areas are discussed. Laboratory included.

BIOCH 327 Biochemistry (3 credits)
Focuses in depth on the structure, function, and properties of carbohydrates, lipids, amino acids, proteins and nucleic acids in biological systems. Topics include protein structure and folding, control and energetics of metabolic pathways, the structure, function and mechanisms of enzymes reactions and a molecular level look at the central dogma of DNA to RNA to protein and DNA-based information technology.

BIOCH 427 Advanced Biochemistry (3 credits)
Explores advanced topics in biochemistry, focusing on structure-function analyses of biomolecules and the chemical and evolutionary foundations of metabolic networks. Emphasis will be placed upon using primary literature and advanced monographs to understand research methodologies and current problems and topics in biochemistry.

BME 101 Introduction to Biomedical Engineering (3 credits)
Introduces the biomedical engineering field, including the variety of career pathways available and the preparation that is required to pursue these careers. Ways in which biomedical engineers analyze and model biological systems and apply engineering principles to solutions of design problems are explored.

BME 205 Problem Solving and Design (4 credits)
Explores the fundamental principles of design and the application of engineering principles in solving biological, physiological and medical problems. Students work in teams to address the technical, social, ethical, legal and economic aspects of a structured problem within the biomedical field.

BME 210 Thermodynamics (3 credits)
Explores the concepts of thermodynamics, particularly as they apply to biological systems. Topics include states of matter, the laws of thermodynamics, thermodynamic energies, phase changes, chemical equilibrium and chemical kinetics.

BME 230 Biofluids (3 credits)
Focuses on principles of fluid mechanics, including mass, momentum and energy conservation, hydrostatics, control volume analysis and flow.

BME 313 Biostatistics (3 credits)
Focuses on the fundamental tools of statistical inference. Probability distributions, hypothesis testing, power analysis, regression analysis and correlation analysis are covered in the context of biomedical engineering applications.

BME 315 Biomaterials (4 credits)
Examines the structure and function of natural and synthetic biomaterials. Explores molecular level interactions between biomolecules and biomaterials in the design of novel biomaterials for applications such as implants, drug delivery systems, biosensors and engineered materials such as artificial skin and bone growth scaffolds.

BME 320 Biomedical Engineering Internship (3 credits)
Provides an opportunity to gain professional workforce experience. A minimum of 120 hours of on-site work experience is required. Emphasis is placed on the integration and application of academic content appropriate to the workplace. This course may not be repeated for credit and may not be used as a substitute for the senior capstone.

BME 325 Transport Processes (3 credits)
Examines membrane physiology and transport mechanisms at the cellular and molecular levels. Engineering applications to drug delivery, gene therapy, and the design of biomedical devices and processes are emphasized.

BME 330 Bioelectric Systems (3 credits)
Studies bioelectrically active tissues and organs in neurological, muscular, and cardiovascular systems. Topics include bioelectric currents and potentials, measurements of biological electrical fields, volume conductor theory, electromanipulation of cells, bone repair and neuronal growth. Applications to the development of biomedical devices and other advances are discussed.

BME 335 Instrumentation (3 credits)
Reviews mechanical, chemical, electrical and biological principles for biomedical measurements. Instrumentation for biosensing, bioimaging, and the measurement of bioelectrical signals, temperature, blood pressure and body chemistry is discussed.

BME 340 Systems Physiology (4 credits)
Emphasizes a quantitative approach to the function of the human body. Tissues and organ systems are examined using principles from engineering kinetics and transport processes. Pathophysiology of disease states is explored.

BME 365 Independent Research in Biomedical Engineering (3 credits)
Provides an opportunity to conduct independent research in an on-campus laboratory under the supervision of a biomedical engineering faculty member. This course may be repeated for credit. This course cannot be used as a substitute for the senior capstone.

BME 380 Biomechanics (4 credits)
Introduces the fundamental principles of biomechanics as they relate to hard and soft tissues. Topics include force analysis, mechanics of deformable bodies, stress and strain, multiaxial deformations, stress analysis and viscoelasticity.

BME 425 Synthetic Biology (3 credits)
Focuses on the scientific foundation and concepts of synthetic biology and biological engineering. The application of synthetic biology to practical challenges is emphasized in the context of societal, ethical and regulatory issues.

BME 450 Senior Research Capstone (5 credits; Upper-level WI)
Provides an opportunity for the student to develop and conduct a scientific research project on campus. A minimum of 180 hours of laboratory work is required. Under the direction of a faculty mentor, each student performs independent and original research that is part of the faculty member's ongoing research program. Emphasis is on honing oral and written skills in the context of scientific inquiry.

BME 455 Senior Internship Capstone (5 credits; Upper-level WI)
Provides an opportunity to gain professional workforce experience. A minimum of 180 hours of on-site work is required. The work must integrate and apply academic content appropriate to the workforce placement. Emphasis is on honing oral and written skills in the context of the internship experience.

BME 460 Senior Research Capstone (9 credits; Upper-level WI)
Provides an opportunity for the student to develop and conduct a scientific research project on campus or off campus A minimum of 324 hours of laboratory work is required. Under the direction of a Stevenson or host mentor, each student performs independent and original research that is part of the mentor's ongoing research program. Emphasis is on honing oral and written skills in the context of scientific inquiry.

BME 465 Senior Internship Capstone (9 credits; Upper-level WI)
Provides an opportunity to gain professional workforce experience. A minimum of 324 hours of on-site work is required. The work must integrate and apply academic content appropriate to the workforce placement. Emphasis is on honing oral and written skills in the context of the internship experience.

CHEM 115 General Chemistry I/CHEM 115H Honors General Chemistry I (3 credits; SR-L when taken with CHEM 115L)
Introduces the structure of matter and its behavior from a chemical perspective. Topics discussed include nomenclature, stoichiometry, chemical reactions, quantum theory, chemical bonding, periodicity, gases, and atomic and molecular structure.

CHEM 115L General Chemistry I Laboratory/CHEM 115HL Honors General Chemistry I Laboratory (1 credits; SR-L when taken with CHEM 115)
Introduces students to working safely in a chemistry laboratory and keeping a laboratory notebook. Experiments performed include the physical properties of matter, chromatography,

analysis of hydrates, solubility of inorganic salts, acids and bases, calorimetry, color and absorption of light, gravimetric analysis, gas laws, chemical bonding and molecular modeling. Students will learn laboratory techniques, instrumentation and molecular modeling.

CHEM 116 General Chemistry II/CHEM 116H Honors General Chemistry II (3 credits)
Introduces the states of matter including liquids, solids and solutions, followed by discussion of chemical principles including kinetics, equilibrium, acids and bases, thermodynamics, electrochemistry, and nuclear chemistry.

CHEM 116L General Chemistry II Laboratory/CHEM 116HL Honors General Chemistry II Laboratory (1 credit)
Focuses on the performance of a selection of basic laboratory procedures including molecular modeling, colligative properties, kinetics, equilibrium, titration, pH of acids and bases, buffer systems, LeChatelier's principle, solubility product constants, qualitative analysis and electrochemistry. Emphasis is placed on instrumentation, maintaining a laboratory notebook, using correct techniques and utilizing chemical software programs.

CHEM 210 Organic Chemistry I (3 credits)
Introduces the physical and chemical properties of alkanes, alkenes, alkynes, and alcohols. This course emphasizes organic nomenclature, syntheses, stereochemistry, and reaction mechanisms.

CHEM 210L Organic Chemistry I Laboratory (1 credit)
Continues education in safely working in a chemistry laboratory and keeping laboratory records. Students are introduced to common techniques associated with the preparation, purification, and chemical characterization of organic compounds.

CHEM 211 Organic Chemistry II (3 credits)
Studies the physical and chemical properties of aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives, enolates, amines, and selected special topics. Syntheses and reaction mechanisms are stressed throughout the course.

CHEM 211L Organic Chemistry II Laboratory (1 credit)
Continues education in safely working in a chemistry laboratory and keeping a laboratory records. This course involves the synthesis and characterization of compounds by physical means and spectroscopy and unknown identification. Spectroscopies covered in depth include IR, NMR, and MS.

CHEM 340 Medicinal and Drug Chemistry (3 credits)
Studies drugs used in therapeutics and presents medicinal chemistry from the chemical point of view. The topics include the classification of drugs, the pharmacology and mechanism of drug action, drug delivery, drug metabolism, structure activity relationship (SAR) and quantitative structure (QSAR) studies, potency, toxicology, and target selectivity.

FYS 100 First Year Seminar (1 credit)
Assists first-year students to identify and use specific strategies for academic, personal, and social success in college. The First-Year Seminar also serves as a tool to introduce students to the career and professional development model that will guide them through their time at Stevenson University. Additional topics discussed in first-year seminar include, but are not limited to, University regulations and procedures, clarifying values and decision-making processes, and exploring the principles of career development.

MATH 220 Calculus I/MATH 220H Honors Calculus I (4 credits; QL)
Introduces the students to calculus. Topics include functions, limits, continuity, derivatives, applications of derivatives, and integrals.

MATH 221 Calculus II (4 credits; QL)
Continues the study of calculus. Topics include basic differential equations, techniques of integration, improper integrals, and applications of integration, sequences and series.

MATH 222 Calculus III (4 credits)
Continues the study of calculus with analytic geometry. Topics include the conic sections, plane curves, vectors, parametric equations, and multivariable functions. The course will also cover further applications of motion, area and volume.

MATH 321 Introduction to Differential Equations (3 credits)
Introduces the student to the application of calculus, particularly in the area of mathematical modeling. Topics covered include quantitative and qualitative solutions to ordinary differential equations and systems of equations. Computer-based numerical methods will be introduced. Discrete dynamical systems and chaotic systems will be covered as time permits.

PHYS 215 General Physics I with Calculus (4 credits; SR-L)
Introduces the fundamentals of Newtonian mechanics. Topics include kinematics, gravity, energy, collisions, fluids, and waves. Experimental techniques, including the analysis of data and the identification of errors, are addressed in the accompanying laboratory.

PHYS 216 General Physics II with Calculus (4 credits)
Introduces the fundamentals of electricity, magnetism, and optics. Topics include electrostatics, Ohm's Law, magnetic fields, Faraday's Law, AC circuits, Maxwell's equations, wave motion, geometrical optics, diffraction, and interference. Laboratory experiments are related to the lecture series. Laboratory included.

Discuss how general education requirements will be met.

The Stevenson Educational Experience (SEE) consists of general education and major-specific coursework. The SEE general education requirements include writing and communication

intensive courses and distribution courses in the liberal arts and sciences, as outlined below.[16] Some programs may require specific courses to fulfill general education requirements, but no single course can fulfill more than one distribution area in fulfilling a SEE requirement.

Writing and Communication Requirement (15 credits):
All bachelor's degree-seeking students must complete courses that fulfill the SEE Writing and Communication requirement: two writing instruction courses, two writing-intensive (WI) courses, and one communication-intensive (CI) course.

Two writing instruction courses:

- ENG 151 (3 credits)
- ENG 152 (3 credits)

Note: ENG 153 Honors Writing Seminar (4 credits) fulfills the writing instruction requirement.

Two Writing Intensive (WI) courses:

- At least one WI course must be in the student's major area of study.
- One WI course must be at the 200-level.
- One WI course must be at the 300-level or 400 level.

Required courses in the proposed program which fulfill WI requirements include SCI 215 Writing in the Sciences and the Biomedical Engineering Research and Internship Capstone courses.

One Communication Intensive (CI) course

Please note : A single course may fulfill either a WI or CI standard. No single course may count as both writing intensive and communication intensive. A single course can fulfill either a WI or CI requirement and a liberal arts and sciences distribution requirement.

Liberal Arts and Sciences Distribution Requirement (37-39 credits).
All bachelor's degree-seeking students must complete courses that fulfill the SEE liberal arts and sciences distribution requirement. No single course may count in more than one distribution area for the purpose of fulfilling the SEE requirement. The discipline areas are represented by the course prefix designators that precede the course number in the catalog (e.g., PHIL, REL, MATH).

Humanities (HUM; 12 credits)
Four courses in at least three different discipline areas are required. ENG 151 and ENG 152 may not be used to fulfill this requirement.

Science and Mathematics (SR, SR-L, QL; 10–12 credits)
Three courses in at least two different discipline areas are required. Additionally,

- One course must be a laboratory science (SR-L).
- One course must carry the MATH designation and QL label.

[16] Stevenson University, 2018-2019 Undergraduate Academic Catalog Online Version, http://stevenson.smartcatalogiq.com/2018-2019/Undergraduate-Catalog/Academic-Information/University-Degree-Requirements/The-Stevenson-Educational-Experience-Requirements-for-Bachelor-s-Degrees

Required courses in the proposed program which fulfill the Science and Mathematics distribution requirement are BIO 113 General Biology I/BIO 113L General Biology I Laboratory (SR-L), CHEM 115 General Chemistry I/CHEM 115L General Chemistry I Laboratory (SR-L), and MATH 220 Calculus I (QL).

Social Sciences (SS; 6 credits)
Two courses in two different discipline areas are required.

Fine Arts (FA; 3 credits)
One course in the fine arts is required.

Grade Requirements:
The minimum passing grade for ENG 151 and ENG 152 is a "C". Students must earn a minimum grade of "D" in courses that are used to fulfill only SEE requirements. Students must earn a minimum grade of "C" in any course that fulfills both a major requirement and a SEE requirement.

Identify any specialized accreditation or graduate certification requirements for this program and its graduates.

The proposed program will seek accreditation from the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). This accreditation will be sought upon the completion of the program's first graduate, according to ABET guidelines. General Criteria must be met relating to Students, Program Educational Objectives, Student Outcomes, Continuous Improvement, Curriculum, Faculty, Facilities, and Institutional Support.[17] In addition, there are program-specific requirements regarding curriculum in biomedical engineering programs. Biomedical engineering programs "must prepare graduates with experience in: (a) Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics; (b) Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems; (c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes; and (d) Making measurements on and interpreting data from living systems."[18] The proposed program has been designed to meet these accreditation requirements.

If contracting with another institution or non-collegiate organization, provide a copy of the written contract.

Not Applicable

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[17] ABET, *Criteria for Accrediting Engineering Programs 2018-2019,* http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2018-2019/#1, accessed 16 August 2018.

[18] ABET, *Criteria for Accrediting Engineering Programs 2018-2019 Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs*, http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2018-2019/#3, access 16 August 2018.

Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete and timely information on the curriculum, course and degree requirements, nature of student/faculty interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.

As this program is in the proposal stage, specific evidence is not directly available for this program. However, the University will provide similar resources to students in the Biomedical Engineering program as are provided for other undergraduate programs. Information regarding curriculum, course and degree requirements, including a suggested course sequence that demonstrates how the program can be completed in four years, is provided via the Stevenson University Catalog (www.stevenson.edu/academics/catalog) and the Student Academic Planning tool which requires a secure login and is individualized for each program and each student. Information about the learning management system (Blackboard), the availability of academic support services and financial aid resources, and costs and payment policies are found on various pages within the SU website (www.stevenson.edu) and the secure internal SU portal page (login required).

Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accurately represent the proposed program and services available.

The Stevenson University homepage links to five major pages, two of which (Academics, Admissions & Aid) contain advertising, recruiting and admissions information. The information available includes, but is not limited to, admissions criteria and deadlines, academic program information, financial aid information and other information of interest to prospective students and their families. The Office of Academic Affairs works closely with the Offices of Admissions and Marketing and Digital Communication to develop and maintain program-specific marketing materials.

H. Adequacy of Articulation

If applicable, discuss how the program supports articulation with programs at partner institutions.

Stevenson University allows block transfer of general education requirements from Maryland community colleges. Transfer students who have completed an Associate's degree have met Stevenson's general education requirements and can immediately begin taking program requirements. In addition, the University has developed program-specific articulation agreements with local community colleges which enable seamless transfer. The proposed program will pursue articulation agreements with relevant science, math, and engineering programs at Maryland community colleges.

I. Adequacy of Faculty Resources

Provide a brief narrative demonstrating the quality of program faculty. Include a summary list of program faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the courses each faculty member will teach (in this program).

The science and mathematics courses will be taught by existing full-time faculty in the Fine School of the Sciences as described in the table below. All full-time faculty have at least a Master's Degree in a scientific or mathematical field relevant to their teaching responsibilities. Upon program approval, the University will hire a Program Coordinator who holds a terminal degree in biomedical engineering or a related engineering field. The Program Coordinator will be a 10-month faculty administrator with responsibility for advising and teaching in the biomedical engineering program and conducting research with students in his/her field of expertise. In addition, the Program Coordinator will lead the development and assessment of the curriculum and oversee the administration of the program. Additional full-time engineering faculty, all of whom will hold relevant advanced degrees appropriate to their rank, will be hired as enrollment warrants. Adjunct faculty who are professionals and/or scholars in the biomedical or a related engineering field will teach on an as needed basis. As practicing professionals and scholars, these adjunct faculty will bring a practical perspective to the classroom and provide students with a learning experience that is relevant to the workplace and their career paths.

Table 6. Existing Stevenson University Faculty Teaching in the Proposed Program

Name	Academic Degree/Field	Academic Title/Rank	Status	Courses
Kaitlin Bailey	M.A./Chemistry	Lecturer, Chemistry	Full-Time	CHEM 115, 115L, 210L
Sarah Blanset	Ph.D./Mathematics	Associate Professor, Mathematics and Physics	Full-Time	MATH 220, 222
Mark Branson	Ph.D./Mathematics	Assistant Professor, Mathematics and Physics	Full-Time	MATH 220, 221, 222, 321
Rebecca Burgess	Ph.D./Genetics and Development	Assistant Professor, Biological Sciences	Full-Time	BIO 113, 113L, 230, 310, 330
Jeremy Burkett	Ph.D./Chemistry (Bioinorganic)	Associate Professor, Chemistry	Full-Time	CHEM 115, 115L, 116, 116L
Carolyn Danna	Ph.D./Neuroscience	Senior Lecturer, Biological Sciences	Full-Time	BIO 113, 113L, 222, 322

Timothy Dwyer	Ph.D./Biochemistry	Professor, Chemistry	Full-Time	BIOCH 327, 427
Rivka Glaser	Ph.D./Human Genetics and Molecular Biology	Assistant Professor, Biological Sciences and Honors Program Director	Full-Time	BIO 113, 113L, 230, 330
William Harrell	Ph.D./Organic Chemistry	Assistant Professor, Chemistry	Full-Time	CHEM 210, 210L, 211, 211L, 340
William Hodge	Ph.D./Physics	Associate Professor, Physics	Full-Time	PHYS 215, 216
Michelle Ivey	Ph.D./Physical Chemistry	Professor, Chemistry	Full-Time	CHEM 115, 115L, 116, 116L FYS 100
Wendy Kimber	Ph.D./Developmental Biology	Chair and Professor, Biological Sciences	Full-Time; Admin	BIO 113, 113L, 230, 330
Lorie Lana	Ph.D./Immunology and Virology	Professor, Biological Sciences	Full-Time	BIO 113, 113L
Tracey Mason	Ph.D./Bioinorganic Chemistry	Professor, Chemistry	Full-Time	FYS 100, Capstone Courses
Neal Miller	Ph.D./Astronomy	Assistant Professor, Physics	Full-Time	MATH 220
Steven Mrozinski	M.S./Forensic Sciences	Instructor, Biological Sciences	Full-Time	BIO 113, 113L, 217
Carol Schmidhauser	M.S./Zoology	Instructor, Biological Sciences	Full-Time	BIO 222, 322
Kerry Spencer	Ph.D./Critical and Creative Writing	Senior Lecturer, Science Writing	Full-Time	SCI 215, Capstone Courses
Sarah Walsh	M.S./Neurobiology and Anatomy	Lecturer, Biological Sciences	Full-Time	BIO 222, 322
Dawn Ward	Ph.D./Synthetic Organic Chemistry	Associate Professor, Chemistry	Full-Time	CHEM 210, 210L, 211, 211L
Benjamin Wilson	Ph.D./Mathematics	Assistant Professor, Mathematics and Physics	Full-Time	FYS 100 MATH 220, 321

Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidence-based best practices, including training in pedagogy that meets the needs of students, the learning management system, and evidence-based best practices for distance education (if offered).

Faculty have access to a variety of professional development options and resources which are accessible via a Faculty Development portal page (login required). The Faculty Development program includes peer-led workshops on pedagogical techniques, training sessions, and the availability of expert individualized consultation within identified annual themes such as Blackboard, Advising, and Diversity and Inclusion in the Classroom. In addition, faculty have access to professional development funds to support attendance at professional meetings that include pedagogy workshops and presentations on the scholarship of learning and teaching.

J. Adequacy of Library Resources

Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program.

Library resources at Stevenson University are available through the library's webpage at stevensonlibrary.org and at three convenient campus locations, Greenspring, Owings Mills and the Learning Commons, also at Owings Mills. The main Stevenson University Library physical location is maintained at the Greenspring campus location. In addition to print books, videos, and other materials at Greenspring, students enjoy access to many specialized databases, featuring the full text of electronic journals, magazines, books, newspapers, and more. A few of the databases to which Stevenson University Library subscribes include Artstor, SciFinder, Lexis-Nexis Academic, Business Source Direct, the Baltimore Sun, and Science Direct. Approximately 70,000 full text magazines, journals, and newspapers are available, as well as over 200,000 eBooks, forming a significant academic resource for students. All are searchable from home, residence hall, or office. The OneSearch tool, available from the library website, enables researchers to find books, articles and more through a single search box. As noted in Section L, the University is committed to augmenting the available resources with additional engineering-specific resources as needed.

Stevenson University researchers also have access to books, videos and articles through the library's interlibrary loan services and membership in the BREILL Consortium, which, in partnership with other Baltimore-area libraries, allows quick turnaround of materials using a daily courier service.

Knowledgeable and friendly library staff members assist Stevenson University students to identify and locate vetted resources appropriate for their assignments. Reference and research help are available in person, by phone and electronically via text, chat and email. Through AskUsNow, Stevenson University students have live chat access to a librarian 24 hours a day, seven days a week.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment

Provide an assurance that physical facilities, infrastructure, and instructional equipment are adequate to initiate the program, particularly as related to spaces for classrooms, faculty/staff offices, and laboratories for studies in the technologies and sciences.

The Kevin J. Manning Academic Center, a 200,000 square foot building that opened in 2016 at the Owings Mills location, houses the Fine School of the Sciences. The building contains four computer labs (which are updated every 3-5 years), fourteen science teaching laboratories (each of which accommodates 20 students) and 4 dedicated research laboratories along with specialized spaces such as cell culture and instrument laboratories, a 576 square foot free-standing greenhouse, a microscope room and a terrarium/aquarium room with light control. The classrooms are all maintained with fully-equipped teaching stations, a classroom audio-projection system, and whiteboards, and there is wireless capability throughout the building. Specialized software is loaded on faculty and student workstations as needed. Faculty office space in the Academic Center is spacious and lends itself to faculty-student interactions and advising.

All teaching and research laboratories are fully equipped with instrumentation and supplies needed to deliver existing courses and support current faculty and student research. Through careful budget management, replacement or new equipment is purchased when needed as funds allow. As described in Section L, the University intends to purchase the specialized instrumentation and supplies for the proposed biomedical engineering program during a planning year prior to the enrollment of students and the first two years of program implementation.

The University maintains Blackboard as its learning management system in support of both traditional and online courses. Every faculty has access to Blackboard and uses it at a minimum for the loading of syllabi and course/section schedules. Many faculty also use Blackboard to post specific assignments and provide grading feedback.

L. Adequacy of Financial Resources with Documentation

Resources

The first class of students is anticipated to enroll in August 2020, thus Tables 7 and 8 below include a planning year for 2019-2020. Given the indication of interest in engineering programs in general and the strength of the regional employment market for biomedical engineers, it is estimated that 10 students will enroll in the first entering class. A small increase is anticipated in the sizes of the entering classes in years 2 and 3, after which is it expected that the size of the entering class will stabilize. Because engineering programs in general demonstrate notoriously low retention rates, we have conservatively assumed year-to-year retention rates lower than

the University's actual rates (60.7%-76.6%)[19] in calculating the number of returning students to be reflected in the number of full-time students listed below. The Annual Tuition/Fee Rate has been determined using a projected 1.95% annual increase in tuition and an estimated tuition discount rate of 62% for each incoming class.

Table 7. Anticipated Program Resources

Resource Categories	Year 1 Planning	Year 2 2020	Year 3 2021	Year 4 2022	Year 5 2023	Year 6 2024
Reallocated	0	0	0	0	0	0
2. Tuition/Fee Revenue	$0	$142,750	$308,358	$513,224	$776,427	$1,025,573
a. # FT Students	0	10	21	34	50	64
b. Annual Tuition/Fee Rate	$0	$14,275	$14,684	$15,095	$15,529	$16,025
c. Annual Full Time Revenue (a x b)	$0	$142,750	$308,358	$513,224	$776,427	$1,025,573
d. # Part time students	0	0	0	0	0	0
e. Credit Hour Rate	NA	NA	NA	NA	NA	NA
f. Annual Credit Hours	NA	NA	NA	NA	NA	NA
g. Total Part-time Revenue (d x e x f)	$0	$0	$0	$0	$0	$0
3. Grants, Contracts and Other External Sources	$0	$0	$0	$0	$0	$0
TOTAL (Add 1-4)	**$0**	**$142,750**	**$308,358**	**$513,224**	**$776,427**	**$1,025,573**

[19] Stevenson University, *Fall 2017 Fact Book,* https://now.stevenson.edu/depts/oira/Shared%20Documents/Fact%20Book/FACT%20BOOK%202017.pdf, p.21, access 16 August 2018.

Expenses

Faculty/Staff: It is anticipated that a full-time Program Coordinator (a 10-month faculty administrator position) will be hired at the beginning of the planning year in order to facilitate course development and the acquisition of needed equipment. An additional full-time faculty member will be hired in each of Years 4 and 6, as enrollment in the program grows and there is a greater need to offer more specialized engineering courses. Existing support staff in the Laboratory Services unit of the Fine School of the Sciences will be able to support the program in the first two years while students are mainly enrolled in basic science courses. By Year 4, when students are enrolled mainly in specialized engineering laboratory courses, a Biomedical Engineering Laboratory Manager will be hired to support the program.

Equipment: Total expenses of $254,500 are anticipated for the purchase of new equipment that is necessary for the proposed program. These expenses have been estimated by surveying other biomedical engineering programs in the region and working with vendors currently used by the University. Because the majority of courses that students will take upon first enrollment in the proposed program will be foundational math and science courses that already exist, the purchase of new program-specific equipment will be spread over three years, including the planning year.

Library: Expenses for the purchase of subscriptions to program-specific journal databases is estimated to be $10,000 annually. These expenses will begin to be incurred in Year 2 when students begin enrolling in the program.

New or Renovated Space: As described above, the physical facilities are more than adequate to deliver the proposed program. Multiple teaching laboratories are currently available, including one with flexible furniture which can be configured as needed to accommodate a variety of uses. Thus, no new space and no renovations are anticipated to be needed.

Other Expenses: Though no space needs to be built or renovated for the proposed program, some furniture and/or infrastructure such as AV equipment and whiteboards may be needed depending on the laboratory that is designated for use. It is estimated that a cost of $13,020 for this work will be incurred during the planning year. Also during the planning year, approximately $30,000 will be spent on durable instructional supplies and consumables in anticipation of student enrollment. In the subsequent two years, the cost for consumable supplies is expected to decrease until it stabilizes at approximately $18,000 annually. In Year 6, which will be the fifth year of student enrollment, it is anticipated that the program will pursue accreditation and fees of $13,900 will be incurred in that year for the initial accreditation.

Table 8. Anticipated Program Expenses

Expenditure Categories	Year 1 Planning	Year 2 2020	Year 3 2021	Year 4 2022	Year 5 2023	Year 6 2024
1. Faculty (b + c below)	$124,676	$124,676	$124,676	$221,728	$221,728	$318,780
a. # FTE	1	1	1	2	2	3
b. Total Salary	$97,403	$97,403	$97,403	$173,225	$173,225	$249,047
c. Total Benefits	$27,273	$27,273	$27,273	$48,503	$48,503	$69,733
2. Admin Staff (b + c below)	$0	$0	$0	$0	$0	$0
a. # FTE	0	0	0	0	0	0
b. Total Salary	$0	$0	$0	$0	$0	$0
c. Total Benefits	$0	$0	$0	$0	$0	$0
3. Support Staff (b + c) below)	$0	$0	$0	$64,000	$64,000	$64,000
a. # FTE	0	0	0	1	1	1
b. Total Salary	$0	$0	$0	$50,000	$50,000	$50,000
c. Total Benefits	$0	$0	$0	$14,000	$14,000	$14,000
4. Equipment	$84,834	$84,833	$84,833	$0	$0	$0
5. Library	$0	$10,000	$10,000	$10,000	$10,000	$10,000
6. New or Renovated Space	$0	$0	$0	$0	$0	$0
7. Other Expenses	$43,020	$19,000	$18,000	$18,000	$18,000	$31,900
8. TOTAL (Add 1-7)	**$252,530**	**$238,509**	**$237,509**	**$313,728**	**$313,728**	**$424,680**

M. Adequacy of provisions for evaluation of program

Discuss procedures for evaluating courses, faculty and student learning outcomes.

All course evaluations are managed centrally by the Office of Institutional Research and Assessment (OIRA). Course evaluations are administered online each semester in all sections of every course. Stevenson University is currently using the EvaluationKIT system, which is able to pull instructor and student enrollment information directly from Blackboard, the course

management system currently being used. This system enables OIRA to make feedback available to faculty and the appropriate academic administrators immediately after the end of a semester. University-wide, response rates average above 50%. Faculty are expected to reflect on the feedback received using the *Faculty Response to Student Evaluations* form, which is submitted to the appropriate department chair/program coordinator.

Assessment of student learning outcomes takes place at the course, program, and institutional levels. Each course offered at Stevenson University is required to have a syllabus that conforms to the institutional syllabus template. A list of measurable student learning outcomes is required by the syllabus template. The achievement of these outcomes is measured by the course faculty using grades on course assessments. At the departmental or program level, samples of student artifacts from key assessments which have been linked to course outcomes are used to document student achievement of course and program outcomes in an annual cycle of assessment. In the sciences, including the proposed program, the capstone courses are assessed in this way as a culminating experience. In addition, each academic program undergoes a comprehensive program review (including external review) on a five-year cycle. Programs with external accreditation follow the review cycle of the relevant accrediting body.

Explain how the institution will evaluate the proposed program's effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.

As described above, programs at Stevenson University are reviewed according to an established program review cycle and revised, as appropriate to reflect the mission and vision of the University and meet the needs of the marketplace. The approval process for new courses requires a matrix which demonstrates alignment of course outcomes with program outcomes. The matrix becomes a course map, the purpose of which is to demonstrate the alignment of each course assessment to course and program outcomes. These tools ensure alignment at all levels of the curriculum and are essential in evaluating program effectiveness.

Student retention is monitored closely by the Success Coaches and the Office of Student Success. First year students are assigned a Success Coach with whom they meet a minimum of 3-4 times each semester of the freshman year. The purpose of these meetings is to ensure the student is acclimating to the University and finding all of the resources he/she needs in order to be successful. As students move into subsequent years, they are assigned an advisor within their program for specialized academic advising. However, the Office of Student Success continues follows up with students at any level who may be having academic or personal difficulty or have not registered in order to ensure they are supported and retained.

Student and faculty satisfaction is measured by campus-wide surveys, some of which are nationally normed. Surveys are administered on a rotating schedule in order to minimize fatigue and optimize the response rates. The cost-effectiveness of programs and initiatives is evaluated through the University's annual planning and budgeting process and a continuous cycle of data reporting and assessment in every unit of the institution. At the beginning of a fiscal year, a

document outlining university-wide initiatives is published for the campus community and the assessment of those initiatives is ongoing throughout the year until a final assessment is published at the end of the fiscal year. Planning for the next fiscal year is then based on the assessment of the previous year's initiatives.

N. Consistency with the State's Minority Student Achievement Goals

Discuss how the proposed program addresses minority student access and success, and the institutions cultural diversity goals and initiatives.

Stevenson University's minority student population is among the highest within Maryland's private colleges and universities. Each year, approximately one-third of the entering class of first-year students qualify for federal Pell grants and are from "educationally disadvantaged backgrounds." In the 2016-2017 academic year, 45% of the total undergraduate student population represented minority groups.[20] The diverse student population is the result of an institutional plan to recruit students from diverse backgrounds.

Stevenson University has made a commitment to attracting transfer students that has increased the diversity of the student population. Specifically, approximately one-third of new students in recent years have been transfer students predominantly from the state's community colleges where the lower tuition generally attracts the most disadvantaged students. In addition, the recruitment plan of the Office of Admissions has pushed outward geographically from the historic dominance of central Maryland counties, adding another factor that contributes to the increasing diversity of the student body.

Stevenson University has among its guiding documents a diversity statement that along with its mission, vision and values comprise the guiding principles behind all policies of the institution. In order to ensure compliance with the commitment to diversity, Stevenson University has an Office of Multicultural Affairs which serves as a key component of the Student Services unit. This office is responsible for the annual diversity update submitted for publication to the Maryland Independent College & University Association (MICUA).

In compliance with goals of the previous and the current Maryland State Plan for Postsecondary Education to ensure equal opportunity for Maryland's diverse citizenry, the proposed program is consistent with and promotes this plan and the University's commitment to diversity and inclusion among its students, faculty and staff.

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[20] Stevenson University, *Fall 2017 Fact Book,* https://now.stevenson.edu/depts/oira/Shared%20Documents/Fact%20Book/FACT%20BOOK%202017.pdf, accessed 16 August 2018.

O. Relationship to Low Productivity Programs Identified by the Commission

If the proposed program is directly related to an identified low productivity program, discuss how the fiscal resources (including faculty, administration, library, and general operating expenses) may be redistributed to this program.

This section is not applicable to independent institutions.

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

Not Applicable