

The completed and signed proposal should be submitted by the Dean’s Office to: curriculumplanning@asu.edu. Before academic units can advertise undergraduate concentrations or include them in their offerings as described in the university catalogs, they must be recommended for approval by the Senate Curriculum and Academic Programs Committee and approved by the Office of the University Provost.

Definition and minimum requirements:

A concentration is a formalized selection of courses within a major.

- A concentration requires a minimum of 15 credit hours of which at least nine credit hours must be upper division. Specialized concentrations (e.g., Bachelor of Science in Interdisciplinary Studies concentrations) may have additional or different requirements.
- A concentration is offered by a single unit and is intended exclusively for students pursuing a particular major. If a concentration consists of courses from more than one college, the approval of each college Dean is required.

College/School/Institute: Ira A. Fulton Schools of Engineering
Department/Division/School: School of Biological and Health Systems Engineering
Proposing Faculty Group (if applicable):

Are two or more academic units collaborating on this program? No, this is not a joint degree program

If “Yes”, list all the additional college(s)/school(s)/institute(s) that will be involved in the development and resources for the degree program by offering courses, faculty or facilities. Please note: This question does not refer to official joint degree programs. Official joint degree programs are ones in which the degree is jointly conferred by two colleges. If the program is jointly conferred, please complete the Proposal to Establish a New Joint Undergraduate Degree Program.

Existing Degree and Major under which this concentration will be established: BSE Biomedical Engineering
Proposed Concentration Name: Biomedical Devices
What is the first catalog year available for students to select on the undergraduate application for this this program? 2021-2022

Delivery method and campus or location options: *select all locations that apply*
 Downtown Phoenix Polytechnic Tempe Thunderbird West Other: _____
 Both on-campus and ASU Online* - (check applicable campus(es) from options listed above)
 ASU Online only (all courses online and managed by ASU Online)

Note: Once students elect a campus or online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please contact Ed Plus then complete the ASU Online Offering form in [Curriculum ChangeMaker](#) to begin this request.

Proposal Contact


Name: Brent Vernon **Title:** Undergraduate Program Chair, BME
Phone number: 480 352 6926 **Email:** Brent.Vernon@asu.edu

DEAN APPROVAL(S)

This proposal has been approved by all necessary unit and College/School levels of review. I recommend implementation of the proposed organizational change.

College/School/Division Dean name:

Signature: James S. Collofello **Date:** 4/22/2020

College/School/Division Dean name: *(if more than one college involved)* 

Signature: _____ **Date:** / /20

Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.

OVERVIEW

- A. Provide a brief description of the new concentration (including the specific focus of the new concentration, relationship to other concentrations in this degree program, etc.).
- B. Engineering of biomedical devices requires that industry professionals follow good manufacturing procedures, have thoroughly tested to ensure that the product is safe and efficacious, and have comprehensively considered all likely failure modes. Most non-biologic devices include electronics for at least one critical function, thus the depth of expertise in electronic devices including signaling to and/or from sensors is important to a professional in this area. This concentration, in Biomedical Devices in the Bachelor of Science in Engineering in Biomedical Engineering, provides that depth of expertise as well as several additional technical electives to provide the background necessary for graduates to succeed in entry-level positions in the biomedical device industry.
- C. Explain the unit's need for the new concentration (e.g., market demand, research base, direction of the discipline, and interdisciplinary considerations). How will the new concentration complement the existing degree program?
- D. The current BSE in Biomedical Engineering includes courses that will be available in this Biomedical Devices concentration; however, we are adding a concentration in Biological Devices that will differ from our existing curriculum. Thus, we need to codify the current curriculum, which emphasizes development of electrical devices for medical applications, as a concentration of its own. The US Food and Drug Administration Center for Devices and Radiological Health has jurisdiction over any medical product that is not a drug or a biologic. Thus, this concentration will provide education for students seeking to work in the biomedical industry making all products that fall into this category.

1. Collaboration and Impact

- A. Faculty governance

Attach a supporting letter from the chair of the academic unit verifying that the proposed concentration has received faculty approval through appropriate governance procedures in the unit and that the unit has the resources to support the concentration as presented in the proposal, without impacting core course resources.

Letter attached from Michael Caplan, Program Chair for the BSE in Biomedical Engineering

- B. Other related programs

Identify other related ASU programs and outline how the new concentration will complement these existing ASU programs.

The most closely related programs to the Biomedical Engineering (BME) concentration in Biomedical Devices are Electrical Engineering (EEE) and Mechanical Engineering (MEE). Although there is one course, biomechanics, offered by both BME and Kinesiology (which is currently a requirement in the BME BSE curriculum as BME416 and for which an impact statement for its change to BME316 has already been made by Kinesiology and reviewed by all relevant bodies), there is no other overlap at the undergraduate level between these programs. As for EEE and MEE, BME students in this concentration will likely take EEE and/or MEE courses as electives and vice versa for students in those programs taking courses in this concentration as electives. Our programs are currently collaborating on a few capstone design teams (e.g., one team is 2 EEs with 2 BMEs and another team is 3 MEs with 2 BMEs) with the students each taking the capstone design course in their respective programs. This concentration will further specialize the BME students to be able to take more elective courses (some of which will be from EEE and MEE) and be better prepared to collaborate on joint projects such as capstone design projects. This concentration will not require any resources to be allocated from these programs, and any BME students taking elective courses will be in classes that already exist and have open seats (therefore no action on the part of EEE or MEE is needed).

The Biotechnology and Bioenterprise program from the New College and the new SBHSE Biomedical Devices concentration would be complementary programs in several ways. First, several courses in the Biotechnology and Bioenterprise program would also be appropriate related technical electives for students in the SBHSE biomedical devices concentration including STP 310: Design and Analysis of Experiments, TMC 320: Funding the Enterprise, and TMC 330: Leading the Enterprise. Additionally, Biotechnology and Bioenterprise students may also consider taking BME 394 or 494 topic courses that align with their interest areas (and are open to non-BME majors). We would hope that this would provide collaborative opportunities for students from both programs. Faculty from the Biotechnology and Bioenterprise program have provided a

statement support recognizing the value of a complementary program that approaches many of the same topics and problems from an engineering perspective.

- a. Attach a letter of collaboration and impact from each Dean, or Dean's designee at the Assistant or Associate Dean level, from impacted programs. Refer to the Provost's Office Curriculum Development website (<https://provost.asu.edu/node/3227>) for guidelines on collaboration and impact statements.

- C. Attach a supporting letter from each college/school from which individual courses, or the entire concentration, are taken.

Attached

2. Academic Curriculum and Requirements

- A. Attach a PDF copy of the assessment plan printed from the University Office of Evaluation and Educational Effectiveness assessment portal demonstrating UOEEE's approval of your assessment plan for this program. Visit the assessment portal at <https://uoeee.asu.edu/assessment-portal> or contact uoeee@asu.edu with any questions.

- B. Curricular Checksheet

Attach a PDF copy of the curriculum checksheet from BAMB to the proposal submission. The curricular checksheet should outline all core/required courses and program specific electives. To retrieve the checksheet in BAMB:

1. Select the "Cheetsheet" tab for the program.
2. From the tab, select "Preview Cheetsheet." The preview will open in a new window.
3. Select "Save as PDF" in upper right-hand corner of the page.

2021 Course List for Biomedical Engineering (Biomedical Devices) (BSE) (Proposed)

Ira A. Fulton Schools of Engineering | BOEOPQF

Major Requirements	Credit Hours	Min. Grade
Lower Division		
BIO 181: General Biology I (SQ)	4	C
CHM 114: General Chemistry for Engineers (SQ)	4	C
CHM 231: Elementary Organic Chemistry (SQ) AND	4	C
CHM 235: Elementary Organic Chemistry Laboratory (SQ)		
ECN 211: Macroeconomic Principles (SB) OR	3	C
ECN 212: Microeconomic Principles (SB)		
EEE 202: Circuits I	4	C
PHY 121: University Physics I: Mechanics (SQ)	3	C
PHY 122: University Physics Laboratory I (SQ)	1	C
PHY 131: University Physics II: Electricity and Magnetism (SQ)	3	C
PHY 132: University Physics Laboratory II (SQ)	1	C
MAT 265: Calculus for Engineers I (MA)	3	C
MAT 266: Calculus for Engineers II (MA)	3	C
MAT 267: Calculus for Engineers III (MA)	3	C
MAT 275: Modern Differential Equations (MA)	3	C
Major Lower Division		
BME 100: Introduction to Biomedical Engineering	3	C
BME 122: Statistics for Biomedical Engineers	2	C
BME 182: Biomedical Engineering Product Design and Development I	1	C
BME 200: Conservation Principles in Biomedical Engineering	3	C
BME 210: Programming for Biomedical Engineers: Introduction to Computers, Programming and Data (CS)	3	C
BME 213: Biomedical and Bioengineering Ethics	1	C
BME 214: FDA Regulatory Processes and Technical Communications	1	C
BME 235: Physiology for Engineers	4	C
BME 282: Biomedical Engineering Product Design and Development II	1	C
Major Upper Division		
BME 300: Bioengineering Product Design	3	C
BME 301: Numerical Methods in Biomedical Engineering	2	C
BME 316: Biomechanics for Biomedical Engineers	3	C
BME 318: Biomaterials	4	C
BME 331: Transport Phenomena for Biomedical Engineering	3	C
BME 340: Thermodynamics for Biomedical Engineers	3	C
BME 350: Signals and Systems for Bioengineers	3	C
BME 370: Microcomputer Applications in Biomedical Engineering	3	C
BME 382: Biomedical Engineering Product Design and Development III	1	C
BME 413: Biomedical Instrumentation (L)	3	C
BME 417: Biomedical Engineering Capstone Design I (L)	4	C
BME 423: Biomedical Instrumentation Laboratory (L)	1	C
BME 490: Biomedical Engineering Capstone Design II (L)	4	C

Electives	Credit Hours	Min. Grade
Upper Division Related Elective	6	C

Track/Groups

Upper Division Related Electives	Upper Division Related Electives continued	Upper Division Related Electives, continued
ACC 382: Accounting and Financial Analysis	EDP 310: Developing as a Leader (SB)	MEE 322: Structural Mechanics
BCH 361: Advanced Principles of Biochemistry	EDP 310: Emotional Intelligence (SB)	MEE 340: Heat Transfer
BCH 367: Elementary Biochemistry Laboratory	EDP 310: Gender Development (SB)	MGT 300: Organization and Management Leadership
	EDP 310: Learning and Memory (SB)	

BCH 461: General Biochemistry	EDP 310: Motivation (SB)	MGT 302: Principles of International Business (G)
BCH 462: General Biochemistry	EDP 310: Understanding the Brain (SB)	MGT 380: Management and Strategy for Nonmajors
BCH 467: Analytical Biochemistry Laboratory (L)	EEE 307: Signal Processing for Digital Culture	MIC 314: HIV/AIDS: Science, Behavior, and Society
BIO 302: Cancer--Mother of All Diseases (L)	EEE 334: Circuits II	MIC 360: Bacterial Physiology
BIO 312: Bioethics (HU) or PHI 320: Bioethics (HU)	EEE 350: Random Signal Analysis	MIC 420: Immunology: Molecular and Cellular Foundations or BIO 420: Immunology: Molecular and Cellular Foundations
BIO 331: Animal Behavior	EEE 352: Properties of Electronic Materials	MKT 300: Marketing and Business Performance
BIO 340: General Genetics or MBB 347: Molecular Genetics: From Genes to Proteins	EEE 407: Digital Signal Processing	MKT 370: Professional Sales and Relationship Management
BIO 345: Evolution	EEE 480: Feedback Systems	MKT 390: Essentials of Marketing
BIO 355: Introduction to Computational Molecular Biology (CS) or MAT 355: Introduction to Computational Molecular Biology (CS) or MBB 355: Introduction to Computational Molecular Biology (CS)	EEE 481: Computer-Controlled Systems	MKT 391: Essentials of Selling
BIO 360: Animal Physiology	ENT 305: Principles of Entrepreneurship	MSE 301: Materials and Civilization
BIO 440: Functional Genomics or MBB 440: Functional Genomics	FIN 300: Fundamentals of Finance	MSE 330: Thermodynamics of Materials
BIO 451: Cell Biotechnology: Cell Culture, Immunocytochemistry and Bioimaging	FIN 380: Personal Financial Management	MSE 335: Materials Kinetics
BIO 467: Neurobiology	FSE 301: Entrepreneurship and Value Creation or ENT 360: Entrepreneurship and Value Creation	MSE 355: Structure and Defects
BME 394: Honors Research	HCR 350: Introduction to Clinical Research	MSE 356: Thin Film and Microelectronic Devices Lab
BME 394: SBHSE Research Projects	IEE 300: Economic Analysis for Engineers	MSE 415: Mathematical and Computer Methods in Materials (CS)
BME 492: Honors Directed Study	IEE 320: Extreme Excel	MSE 420: Advanced Metallurgical Alloys and Processes
BME 493: Honors Thesis (L)	IEE 369: Work Analysis and Design (L)	MSE 421: Physical Metallurgy Laboratory
BMI 311: Modeling Biomedical Knowledge	IEE 381: Lean Six Sigma Methodology	MSE 440: Mechanical Behavior of Materials
BMI 465: Introduction to Comparative Genomics	IEE 431: Engineering Administration (L)	MSE 442: Fatigue, Fracture, and Creep of Materials
BUA 380: Small Business Leadership	IND 464: Collaborative Design Development I (L)	MSE 450: Introduction to Materials Characterization
BUA 381: Small Business Accounting and Finance	IND 465: Collaborative Design Development II (L)	MSE 451: Nanomaterials and Electronics Characterization Lab
BUA 383: Small Business Working Relationships	KIN 334: Functional Anatomy and Kinesiology	MSE 458: Electronic, Magnetic, and Optical Properties
BUS 384: Business Operations and Planning	KIN 340: Physiology of Exercise	MSE 460: Nanomaterials in Energy Production and Storage
CEE 384: Numerical Methods for Engineers (CS) or MAE 384: Advanced Mathematical Methods for Engineers (CS)	KIN 412: Biomechanics of the Skeletal System	MSE 470: Polymers and Composites
CHE 475: Biochemical Engineering	KIN 413: Qualitative Analysis in Sport Biomechanics	MSE 471: Introduction to Ceramics
CHM 302: Environmental Chemistry	KIN 414: Electromyographic Kinesiology (L)	MSE 482: Materials Engineering Design (L)
CHM 325: Analytical Chemistry	KIN 440: Exercise Biochemistry	NTR 457: Sports Nutrition
CHM 326: Advanced Analytical Chemistry Laboratory	LES 305: Business Law and Ethics for Managers	PAF 301: Applied Statistics (CS)
CHM 341: Elementary Physical Chemistry or BCH 341: Physical Chemistry with a Biological Focus	LES 380: Consumer Perspective of Business Law	PAF 410: Building Leadership Skills (SB)
CIS 300: Web Design and Development	LSC 347: Fundamentals of Genetics	PHI 306: Applied Ethics (HU)
COM 312: Communication, Conflict, and Negotiation	MAE 318: System Dynamics and Control I	PHI 313: Probability, Evidence, and Decision
	MAE 341: Mechanism Analysis and Design	PHY 361: Introductory Modern Physics
	MAE 417: System Dynamics and Control II	PSY 325: Physiological Psychology
	MAT 300: Mathematical Structures (L)	
	MAT 310: Introduction to Geometry	
	MAT 342: Linear Algebra or MAT 343: Applied Linear Algebra	
	MAT 451: Mathematical Modeling (CS)	

CSE 310: Data Structures and Algorithms	MAT 460: Vector Calculus	PSY 470: Psychopharmacology
CSE 340: Principles of Programming Languages	MAT 462: Applied Partial Differential Equations	SCM 300: Global Supply Operations
CSE 412: Database Management	MBB 343: Genetic Engineering and Society (L) or BIO 343: Genetic Engineering and Society (L)	SOC 334: Technology and Society (L or SB)
DAT 301: Exploring Data in R and Python		STP 421: Probability
ECN 306: Survey of International Economics (SB & G)		STP 429: Applied Regression (CS)
		STS 304: Science, Technology and Society (SB)
		STS 332: Global Issues in Science and Technology (SB)
		TEM 330: Systems Innovation
		TWC 446: Technical and Scientific Reports (L)
		TWC 451: Copyright and Intellectual Property in the Electronic Age

- C. A minimum residency requirement: How many hours of the concentration must be ASU credit?
56

- D. Provide a brief course description for each new course.

Note: All new required courses should be submitted in Curriculum Changemaker and ready for Provost's Office approval before this concentration is put on the CAPC agenda.

N/A

3. Administration and Resources

- A. How will the proposed concentration be administered (including admissions, student advisement, retention, etc.)?

Academic services including admissions, retention, and student advisement will be administered by the School of Biological and Health Systems Engineering Advising Office.

- B. What are enrollment projections for the next three years?

	1st Year	2nd Year (Yr 1 continuing + new entering)	3rd Year (Yr 1 & 2 continuing + new entering)
Number of Students (Headcount)	60	120	180

- C. What are the resource implications for the proposed concentration, including any projected budget needs? Will new books, library holdings, equipment, laboratory space and/or personnel be required now or in the future? If multiple units/programs will collaborate in offering this concentration, please discuss the resource contribution of each participating program. Letters of support must be included from all academic units that will commit resources to this concentration.

No additional resources are required.

D. Please list the primary faculty participants regarding this proposed concentration. For interdisciplinary concentrations, please include the relevant names of faculty members from across the University.

Name	Title	Area(s) of Specialization as they relate to proposed concentration
Vikram Kodibagkar	Associate Professor	MRI probe and technique development for cellular, molecular and metabolic imaging
Jit Muthuswamy	Associate Professor	Neural Interfaces, neuromodulation, BioMEMS
James Abbas	Associate Professor	Neural engineering, rehabilitation, prostheses, and biomimetic design
Christopher Buneo	Associate Professor	Motor control, neurophysiology, neuroprosthetics
Bradley Greger	Associate Professor	Neural engineering, vision restoration, neuroprosthetics, epilepsy
Stephen Helms Tillery	Associate Professor	Cortical neurophysiology, neural control of movement, neuroprosthetics
Claire Honeycutt	Assistant Professor	Neural control of balance, reaching and grasp
Jeff Kleim	Associate Professor	Neural plasticity; neurorehabilitation; stroke; Parkinson's disease
Thurmon Lockart	Professor	Biomechanics, biodynamics, biosensors, neuro rehabilitation, gait and posture, fall prevention
Vincent Pizziconi	Associate Professor	Bioresponsive and biomimetic materials
Rosalind Sadleir	Assistant Professor	Neuro imaging and neural activity detection, dynamic physiological monitoring, computational modeling
Marco Santello	Professor	Neural control of movement, neurophysiology, motor learning, hand biomechanics
Sydney Schaefer	Assistant Professor	Human motor control and learning, neurorehabilitation, cognitive aging
Barbara Smith	Assistant Professor	Non-invasive, point-of-care medical diagnostics
Jamie Tyler	Associate Professor	Neural engineering

4. Additional Materials

- A. Prepare and attach a Major Map. If this program will be delivered online as well as in-person, attach a copy of both the major map and the online major map. Please use the "proposed map" function to create a Major Map in [BAMM](#). Instructions on how to create a "proposed major map" in BAMM can be found in the [Build a Major Map Training Guide](#).
- B. *Complete and attach the [Appendix document](#).*
- C. Attach other information that will be useful to the review committees and the Office of the University Provost.

PROVOST OFFICE APPROVAL(S)

This proposal has been approved by all necessary Provost office levels of review. I recommend implementation of the proposed organizational change.

Office of the University Provost

Signature _____

Date: / /20

Note: An electronic signature, email, or a PDF of the signed signature page is acceptable.

**APPENDIX
OPERATIONAL INFORMATION FOR UNDERGRADUATE CONCENTRATIONS**

(This information is used to populate the [Degree Search](#)/catalog website.
Please consider the student audience in creating your text.)

Proposed Major and Concentration Name: BSE in Biomedical Engineering (Biomedical Devices)

1. Marketing Description (*Optional. 50 words maximum. The marketing description should not repeat content found in the program description.*)

Graduates with a BSE in biomedical engineering with a concentration in biomedical devices fill a critical need in the biomedical industry for professionals who understand how regulations must be implemented in the device design and manufacturing processes to create biomedical products that address unmet healthcare needs or improve the human condition.

2. Program Description (150 words maximum)

The BSE program in biomedical engineering with a concentration in biomedical devices provides in-depth knowledge to translate an idea for a health solution into a viable prototype of a biomedical device.

With knowledge gained from courses that cover engineering, life sciences and that tie the two together, graduates are able to apply their skills in an ethical and a sustainable manner to make contributions that address societal and individual needs.

Accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org/>.

3. Contact and Support Information

Building code and room number: (Search ASU map)	ECG 334
Program office telephone number: (i.e. 480/965-2100)	480/965-3028
Program Email Address:	sbhse.advising@asu.edu
Program Website Address:	https://sbhse.engineering.asu.edu
Does this program have a second language requirement?	No

4. Delivery/Campus Information Options

On-campus only (ground courses and/or iCourses)

Note: Once students elect a campus or online option, students will not be able to move between the on-campus and the ASU Online options. Approval from the Office of the University Provost and [Philip Regier](#) (Executive Vice Provost and Dean) is required to offer programs through ASU Online. Please contact Ed Plus then complete the ASU Online Offering form in [Curriculum ChangeMaker](#) to begin this request.

5. Campus/Locations indicate all locations where this program will be offered.

Downtown Phoenix Polytechnic Tempe Thunderbird West Other: _____

6. Career Opportunities & Concentration(s)

Provide a brief description of career opportunities available for this degree program with the proposed concentration. (150 words maximum)

Graduates are well-qualified for entry level positions in the biomedical industry, including areas such as quality assurance, regulatory affairs and project management. Graduates also are highly qualified to seek advanced degrees if they wish to pursue research and design positions.

7. Additional Freshman Admission Requirements

If applicable, list any freshman admission requirements that are higher than and/or in addition to the university minimum undergraduate admission requirements.

minimum 1210 SAT combined evidence-based reading and writing plus math score or minimum 24 ACT combined score **or** 3.00 minimum ABOR GPA **or** class ranking in top 25% of high school class, **and** no high school math or science competency deficiencies

8. Additional Transfer Admission Requirements

If applicable, list any admission requirements for transfer students that are higher than and/or in addition to the university minimum undergraduate transfer admission requirements.

Transfer students with fewer than 24 transferable college credit hours:

1. minimum transfer GPA of 3.00 for fewer than 24 transfer hours, **and**
2. no high school math or science competency deficiencies, **and**
3. minimum 1210 SAT combined evidence-based reading and writing plus math score (or 1140 if taken prior to March 5, 2016) or minimum 24 ACT combined score, **or** 3.00 minimum cumulative high school GPA in ABOR competency courses, **or** class ranking in top 25% of high school class

Transfer students with 24 or more transferable college credit hours must meet EITHER the primary OR the secondary criteria (not both):**Primary Criteria**

1. minimum transfer GPA of 3.00 for 24 or more transfer hours, **and**
2. no high school math or science competency deficiencies (if Admission Services requires submission of a high school transcript)

Secondary Criteria

1. minimum transfer GPA of 2.75 for 24 or more transfer hours, **and**
2. minimum GPA of 3.00 in all critical courses for Terms 1 and 2 (see major map for critical courses)

9. Change of Major Requirements

Standard change of major text is as follows:

If applicable, list any additional requirements for students who may change their major into this program

Admission requirements for many majors in the Ira A. Fulton Schools of Engineering are higher than university admission standards: <https://engineering.asu.edu/admission-requirements>.

Current ASU students should refer to <https://engineering.asu.edu/admission-requirements> for the major change requirements for this program.

10. Keywords

List all keywords used to search for this program (limit 10). Keywords should be specific to the proposed program.

Bio-instrumentation; bio-sensor; medical diagnostic; medical imaging; neural engineering; rehabilitation; neuro-prosthetics; point-of-care technologies.

11. Advising Committee Code

List the existing advising committee code associated with this degree.

UGESNA

*Note: If a new advising committee needs to be created, please complete the following form:
[Proposal to create an undergraduate advising committee](#)*

12. Change of Major E-mail Address

List the contact email address to direct students who are interested in changing to this major.
 sbhse.advising@asu.edu

13. Western Undergraduate Exchange (WUE) Eligible

Has a request been submitted to the University Provost by the Dean to consider this degree program as eligible for [WUE](#)?
 No

*Note: **No** action will be taken during the implementation process with regards to WUE until approval is received from the University Provost.*

14. First Required Math Course

List the first math course required in the major map.
 MAT 265 Calculus for Engineers

15. Math Intensity

- a. List the highest math required on the major map. (This will not appear on Degree Search.)
 MAT 275 Differential Equations
- b. What is the math intensity as indicated by the highest math required on the major map? Math intensity categorization can be found here: <https://catalog.asu.edu/mathintensity>
 Substantial

16. ONET Codes

Identify ONET/SOC codes that should be displayed on Degree Search. ONET/SOC codes can be found at: <http://www.onetonline.org/crosswalk/SOC/>. Alternate titles displayed on Degree Search may vary and can be found at: <https://catalog.asu.edu/alternate-career-titles>.

17-2031.00	.....	Biomedical Engineers	.....
17-2112.02	.....	Biochemical Engineers	.....
41-9031.00	.....	Sales Engineers	.....
17-2112.01	.....	Human Factors Engineers and Ergonomists	.....
17-2199.06	.....	Microsystems Engineers	.....

17. Area(s) of Interest

A. Select **one** (1) primary area of interest from the list below that applies to this program.

- | | |
|--|--|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Health & Wellness |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Humanities |
| <input type="checkbox"/> Business | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Communications & Media | <input type="checkbox"/> Law, Justice & Public Service |
| <input type="checkbox"/> Computing & Mathematics | <input type="checkbox"/> STEM |
| <input type="checkbox"/> Education & Teaching | <input type="checkbox"/> Science |

- | | |
|--|---|
| <input checked="" type="checkbox"/> Engineering & Technology | <input type="checkbox"/> Social and Behavioral Sciences |
| <input type="checkbox"/> Entrepreneurship | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Exploratory | |

B. Select **one (1)** secondary area of interest from the list below that applies to this program.

- | | |
|--|--|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Health & Wellness |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Humanities |
| <input type="checkbox"/> Business | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Communications & Media | <input type="checkbox"/> Law, Justice & Public Service |
| <input type="checkbox"/> Computing & Mathematics | <input checked="" type="checkbox"/> STEM |
| <input type="checkbox"/> Education & Teaching | <input type="checkbox"/> Science |
| <input type="checkbox"/> Engineering & Technology | <input type="checkbox"/> Social and Behavioral Sciences |
| <input type="checkbox"/> Entrepreneurship | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Exploratory | |

The following fields are to be completed by the Office of the University Provost.	
CIP Code:	_____
Plan Code:	_____

University Office of Evaluation and Educational Effectiveness (/)

**Biomedical
Engineering with
concentration in
Biomedical Devices
(BSE1512497448)**

Department: CBIOHEAENG

College: ES_UG - Ira A Fulton
Schools of
EngineeringLast modified
date Apr 08 2021 1:43 PM
Jessica Meeker
Last modified by (jkentge)

Mission & Goals

Mission: To become a leading biomedical engineering program that is able to effectively engineer novel solutions to improve human health and provide unique interdisciplinary training for the next generation of biomedical engineers.

Goals: Will demonstrate an ability to design biomedical devices to meet specifications under economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.

Program Learning Outcomes

1 The students should be able to apply knowledge of science to solve engineering problems related to biomedical devices.

Concepts: Theoretical concepts of sciences and engineering methodology support and enable the design of biomedical devices.

Competencies: Graduates will have the ability to use principles of engineering and science to design biomedical devices.

Measure 1 1

Breadth of knowledge in Capstone Design project

Performance Criterion 1 1

Faculty Developed Rubric Item: Comprehensiveness of the scientific principles discussed vis-a-vis what principles are needed to fully understand the phenomena at hand. 80% or more students should meet or exceed expectations for this measure.

Measure 1 2

Depth of thought in Capstone Design project

Performance Criterion 1 2

Faculty Developed Rubric Item: The student's ability to synthesize information about different scientific principles to reduce the complexity of the problem and/or better understand the phenomena (critical thinking). 80% or more students should meet or exceed expectations for this measure.

Measure 1 3

Accuracy of thought about scientific principles as applied to the Capstone Design project

Performance Criterion 1 3

Faculty Developed Rubric Item: The student's ability to accurately and independently apply scientific principles to open-ended questions about phenomena related to his/her Capstone Design project (scientific principles). 80% or more students should meet or exceed expectations for this measure.

Assessment Process:

Assessment of student performance in their capstone design projects for both semester 1 and semester 2 of Capstone will be evaluated to assess all measures for all students/teams graduating from the program. Further, 25% of the teams will be assessed for these measures by a committee of 6 to 8 faculty at the conclusion of semester 2 of Capstone (Spring Semester).

2 The students should be able to analyze and interpret data from experiments to validate biomedical devices.

Concepts: Key techniques in the design of biomedical devices are the analysis and interpretation of data collected from validation experiments.

Competencies: Graduates will demonstrate competent use of data analysis and interpretation in the design of biomedical devices.

Measure 2 1

Ability to perform necessary calculations for experiments related to the biomedical device created in Capstone Design.

Performance Criterion 2 1

Faculty Developed Rubric Item: Student's ability to calculate interpretable information accurately for an experiment to validate his/her biomedical device (quantitative reasoning). 80% or more students should meet or exceed expectations for this measure.

Measure 2 2

Ability to apply appropriate statistics to experiments related to the biomedical device created in Capstone Design.

Performance Criterion 2 2

Faculty Developed Rubric Item: Student's ability to apply a valid statistical method to his/her data validating the student's biomedical device. 80% or more students should meet or exceed expectations for this measure.

Measure 2 3

Ability to interpret data from experiments related to the biomedical device created in Capstone Design to inform the student's design process

Performance Criterion 2 3

Faculty Developed Rubric Item: Student's ability to interpret data from a validation experiment for his/her biomedical device (evaluation of evidence). 80% or more students should meet or exceed expectations for this measure.

Assessment Process:

Assessment of student performance in their capstone design projects for both semester 1 and semester 2 of Capstone will be evaluated to assess all measures for all students/teams graduating from the program. Further, 25% of the teams will be assessed for these measures by a committee of 6 to 8 faculty at the conclusion of semester 2 of Capstone (Spring Semester).

3

The students should be able to communicate effectively in written format.

Concepts:

Effective written communication is crucial for the design process for biomedical devices.

Competencies:

Graduates will demonstrate effective written communication as applied to the process of design biomedical devices.

Measure 3 1

Student's grammar and style in writing reports about his/her biomedical device in Capstone Design.

Performance Criterion 3 1

Faculty Developed Rubric Item: Student's ability to write in a style that is easily read and understood (literacy). 80% or more students should meet or exceed expectations for this measure.

Measure 3 2

Student's logic in reports about his/her biomedical device in Capstone Design.

Performance Criterion 3 2

Faculty Developed Rubric Item: Student's reports have a clear chain of logic with no critical gaps. 80% or more students should meet or exceed expectations for this measure.

Measure 3 3

Content of student's writing in reports about his/her biomedical device in Capstone Design.

Performance Criterion 3 3

Faculty Developed Rubric Item: Student's reports accurately describe scientific principles, correctly use scientific terms, and do not overstate conclusions. 80% or more students should meet or exceed expectations for this measure.

Assessment Process:

Assessment of student performance in their capstone design projects for both semester 1 and semester 2 of Capstone will be evaluated to assess all measures for all students/teams graduating from the program. Further, 25% of the teams will be assessed for these measures by a committee of 6 to 8 faculty at the conclusion of semester 2 of Capstone (Spring Semester).

4

The students should be able to design a biomedical system, component or process with realistic constraints

Concepts:

There are important ethical, social, and economic constraints that must be considered in the design of biomedical devices.

Competencies:

Graduates will demonstrate appropriate consideration of ethical, social, and economic constraints during the design of biomedical devices.

Measure 4 1

Student's discussion of ethical constraints in reports about his/her biomedical device in Capstone Design.

Performance Criterion 4 1

Faculty Developed Rubric Item: The level of depth and comprehensiveness of the ethical constraints will be evaluated. 80% or more students should meet (consider the most relevant ethical constraints accurately) or exceed expectations for this measure.

Measure 4 2

Student's discussion of economic constraints in reports about his/her biomedical device in Capstone Design.

Performance Criterion 4 2

Faculty Developed Rubric Item: Students should be able to create a business plan that includes the most important expense categories and project plausible revenue. 80% or more students should meet or exceed expectations for this measure.

Measure 4 3

Student's discussion of social and political constraints in reports about his/her biomedical device in Capstone Design.

Performance Criterion 4 3

Faculty Developed Rubric Item: Upon questioning about his/her project, the student should be able to discuss relevant social and political issues related to his/her biomedical device and how the device might be affected by those social and/or political context (social and behavior sciences). 80% or more students should meet or exceed expectations for this measure.

Assessment Process: Assessment of student performance in their capstone design projects for both semester 1 and semester 2 of Capstone will be evaluated to assess all measures for all students/teams graduating from the program. Further, 25% of the teams will be assessed for these measures by a committee of 6 to 8 faculty at the conclusion of semester 2 of Capstone (Spring Semester).

5

The students should be able to discuss economic, global, environmental, and societal aspects of biomedical devices.

Concepts: As societal, ethical, environmental, global, and economic issues are important in the design of biomedical devices, it is key that students are able to discuss these issues logically and effectively.

Competencies: Graduates will demonstrate effective discussion of societal, ethical, environmental, global, and economic issues in the context of the design of biomedical devices.

Measure 5 1

Student's discussion of global considerations in reports about his/her biomedical device in Capstone Design.

Performance Criterion 5 1

Faculty Developed Rubric Item: The student should understand at least one country other than the US well enough to meet its customers' needs when designing his/her biomedical device (awareness of history, the world, and cultural diversity). 80% or more students should meet or exceed expectations for this measure.

Measure 5 2

Student's discussion of environmental considerations in reports about his/her biomedical device in Capstone Design.

Performance Criterion 5 2

Faculty Developed Rubric Item: The student should understand the environmental regulations/standards most pertinent to his/her biomedical device. 80% or more students should meet or exceed expectations for this measure.

Measure 5 3

Student's discussion of societal considerations in reports about his/her biomedical device in Capstone Design.

Performance Criterion 5 3

Faculty Developed Rubric Item: The student should show awareness of at least one "hot-button" social topic (e.g., "Can your hip replacement kill you?" NYT 1/13/2018) related to his/her biomedical device when designing his/her biomedical device (the humanities and arts or design). 80% or more students should meet or exceed expectations for this measure.

Assessment Process: Assessment of student performance in their capstone design projects for both semester 1 and semester 2 of Capstone will be evaluated to assess all measures for all students/teams graduating from the program. Further, 25% of the teams will be assessed for these measures by a committee of 6 to 8 faculty at the conclusion of semester 2 of Capstone (Spring Semester).

General Education Knowledge Areas

?

Composition, Communication & Rhetoric	✓ Measure	[O3M1] Student's grammar and style in writing reports about his/her biomedical device in Capstone Design. [O3M3] Content of student's writing in reports about his/her biomedical device in Capstone Design.
Mathematics/ quantitative reasoning	✓ Measure	[O1M3] Accuracy of thought about scientific principles as applied to the Capstone Design project [O2M2] Ability to apply appropriate statistics to experiments related to the biomedical device created in Capstone Design. [O2M3] Ability to interpret data from experiments related to the biomedical device created in Capstone Design to inform the student's design process [O3M2] Student's logic in reports about his/her biomedical device in Capstone Design.
Literature, Fine Arts & Humanities	✓ Narrative	6 credits HU student choice
Social/ behavioral sciences	✓ Measure	[O4M2] Student's discussion of economic constraints in reports about his/her biomedical device in Capstone Design. [O4M3] Student's discussion of social and political constraints in reports about his/her biomedical device in Capstone Design.
Natural sciences	✓ Narrative	CHM 114, BIO 181, PHY 121, PHY 122, PHY 131, PHY 132, CHM 231, and CHM 235
American Institutions, Economics & History	✓ Narrative	'C' cultural awareness area and 'H' historical awareness area
Ethics and Ethical Reasoning	✓ Measure	[O4M1] Student's discussion of ethical constraints in reports about his/her biomedical device in Capstone Design.

Civil Discourse/ Civic Knowledge

✓ Measure

[O5M3] Student’s discussion of societal considerations in reports about his/her biomedical device in Capstone Design.

Global Awareness, Diversity & Inclusion

✓ Narrative

'G' global awareness area

University Office of Evaluation and Educational Effectiveness

Contact Us (/contact-us)

Research, Evaluation, Assessment
1130 E. University Dr., Suite 212, Tempe | [map \(http://www.asu.edu/map/interactive/?campus=tempe&building=UCNTRB\)](http://www.asu.edu/map/interactive/?campus=tempe&building=UCNTRB)
(480) 965-9291 | fax (480) 965-9283
[uoeee@asu.edu \(mailto:uoeee@asu.edu\)](mailto:uoeee@asu.edu)

Testing and Scanning Services
1130 E. University Dr., Suite 204, Tempe | [map \(http://www.asu.edu/map/interactive/?campus=tempe&building=UCNTRB\)](http://www.asu.edu/map/interactive/?campus=tempe&building=UCNTRB)
(480) 965-7146 | fax (480) 965-6859
[uts@asu.edu \(mailto:uts@asu.edu\)](mailto:uts@asu.edu)
















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Contact ASU (<https://contact.asu.edu/>)

2021 - 2022 Major Map

Biomedical Engineering (Biomedical Devices), (Proposed)

School/College:

BOEOPQF

Term 1 0 - 15 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes	
 ASU 101-BME: The ASU Experience	1	C	<ul style="list-style-type: none"> • An SAT, ACT, Accuplacer, IELTS, or TOEFL score determines placement into first-year composition courses. • Mathematics Placement Assessment score determines placement in mathematics course. • ASU 101 or college-specific equivalent First-Year Seminar required of all students. • If ENG 105 is taken, a 3 credit hour applicable elective must also be taken prior to graduation. See advisor. • Prep for success using the First-Year Student Guide. • Join a Fulton community. • Explore engineering and technical professions. 	
 CHM 114: General Chemistry for Engineers (SQ)	4	C		
 MAT 265: Calculus for Engineers I (MA)	3	C		
BME 100: Introduction to Biomedical Engineering	3	C		
BME 182: Biomedical Engineering Product Design and Development I	1	C		
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C		
 Minimum 2.00 GPA ASU Cumulative.				
Term hours subtotal:	15			
<hr/>				
Term 2 15 - 31 Credit Hours Critical course signified by 	Hours	Minimum Grade		Notes
 BIO 181: General Biology I (SQ)	4	C	<ul style="list-style-type: none"> • Create a Handshake profile. • Get involved with EPICS, the Generator Labs, and the Fulton Start-Up Center. 	
 MAT 266: Calculus for Engineers II (MA)	3	C		
 PHY 121: University Physics I: Mechanics (SQ)	3	C		
 PHY 122: University Physics Laboratory I (SQ)	1	C		
BME 122: Statistics for Biomedical Engineers	2	C		
ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition	3	C		
 Complete BME 100 course(s).				
 Complete ENG 101 OR ENG 105 OR ENG 107 course(s).				
 Minimum 2.00 GPA ASU Cumulative.				
Term hours subtotal:	16			
<hr/>				
Term 3 31 - 46 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes	
 MAT 267: Calculus for Engineers III (MA)	3	C		

◆ PHY 131: University Physics II: Electricity and Magnetism (SQ)	3	C
◆ PHY 132: University Physics Laboratory II (SQ)	1	C
BME 210: Programming for Biomedical Engineers: Introduction to Computers, Programming and Data (CS)	3	C
BME 213: Biomedical and Bioengineering Ethics	1	C
BME 214: FDA Regulatory Processes and Technical Communications	1	C
ECN 211: Macroeconomic Principles (SB) OR ECN 212: Microeconomic Principles (SB)	3	C
◆ Minimum 2.00 GPA ASU Cumulative. Complete Mathematics (MA) requirement.		
Term hours subtotal:	15	

- Prep for success using the **Sophomore Guide**.

Term 4 46 - 61 Credit Hours Critical course signified by ◆	Hours	Minimum Grade	Notes
◆ BME 200: Conservation Principles in Biomedical Engineering	3	C	<ul style="list-style-type: none"> • Pursue an undergraduate research experience. • Apply for internships. • Attend career fairs and events.
◆ MAT 275: Modern Differential Equations (MA)	3	C	
BME 235: Physiology for Engineers	4	C	
BME 282: Biomedical Engineering Product Design and Development II	1	C	
EEE 202: Circuits I	4	C	
Term hours subtotal:	15		

Term 5 61 - 75 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ BME 350: Signals and Systems for Bioengineers	3	C	<ul style="list-style-type: none"> • Plan for success using the Junior Guide. • Network at student organization competitions or professional societies.
BME 318: Biomaterials	4	C	
BME 331: Transport Phenomena for Biomedical Engineering	3	C	
CHM 231: Elementary Organic Chemistry (SQ) AND CHM 235: Elementary Organic Chemistry Laboratory (SQ)	4	C	
Term hours subtotal:	14		

Term 6 75 - 90 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ BME 370: Microcomputer Applications in Biomedical Engineering	3	C	<ul style="list-style-type: none"> • Research and prepare for graduate school. • Apply for an engineering 4+1 program. • Develop a professional profile online.
BME 300: Bioengineering Product Design	3	C	
BME 301: Numerical Methods in Biomedical Engineering	2	C	
BME 316: Biomechanics for Biomedical Engineers	3	C	
BME 340: Thermodynamics for Biomedical Engineers	3	C	
BME 382: Biomedical Engineering Product Design and Development III	1	C	
Term hours subtotal:	15		

Term 7 90 - 104 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ BME 417: Biomedical Engineering Capstone Design I (L)	4	C	<ul style="list-style-type: none"> • Select your Upper Division Related Elective courses from the approved list found below or here. • The general studies requirements for HU or SB and the awareness areas do not have to be taken in exact combinations (as outlined on major map). By the end of term 8, all need to
BME 413: Biomedical Instrumentation (L)	3	C	
BME 423: Biomedical Instrumentation Laboratory (L)	1	C	
Upper Division Related Elective	3	C	
Upper Division Humanities, Arts and Design (HU) OR Upper Division Social-Behavioral Sciences (SB)	3		

★ Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).

Term hours subtotal: 14

be completed, however the combinations may vary.

- Plan for success using the **Senior Guide**.
- Use **Handshake** to apply for full-time positions.
- Complete an in person or virtual **practice interview**.

Term 8 104 - 120 Credit Hours Necessary course signified by ★	Hours	Minimum Grade	Notes
★ BME 490: Biomedical Engineering Capstone Design II (L)	4	C	
Upper Division Related Elective	3	C	
Humanities, Arts and Design (HU) AND Cultural Diversity in the U.S. (C)	3		
Humanities, Arts and Design (HU) AND Historical Awareness (H)	3		
Social-Behavioral Sciences (SB) AND Global Awareness (G)	3		
Term hours subtotal:	16		

- Select your Upper Division Related Elective courses from the approved list found below or [here](#).
- The general studies requirements for HU or SB and the awareness areas do not have to be taken in exact combinations (as outlined on major map). By the end of term 8, all need to be completed, however the combinations may vary.

Hide Course List(s)/Track Group(s)

Upper Division Related Electives	Upper Division Related Electives continued	Upper Division Related Electives, continued
ACC 382: Accounting and Financial Analysis	EDP 310: Developing as a Leader (SB)	MEE 322: Structural Mechanics
BCH 361: Advanced Principles of Biochemistry	EDP 310: Emotional Intelligence (SB)	MEE 340: Heat Transfer
BCH 367: Elementary Biochemistry Laboratory	EDP 310: Gender Development (SB)	MGT 300: Organization and Management Leadership
BCH 461: General Biochemistry	EDP 310: Learning and Memory (SB)	MGT 302: Principles of International Business (G)
BCH 462: General Biochemistry	EDP 310: Motivation (SB)	MGT 380: Management and Strategy for Nonmajors
BCH 467: Analytical Biochemistry Laboratory (L)	EDP 310: Understanding the Brain (SB)	MIC 314: HIV/AIDS: Science, Behavior, and Society
BIO 302: Cancer--Mother of All Diseases (L)	EEE 307: Signal Processing for Digital Culture	MIC 360: Bacterial Physiology
BIO 312: Bioethics (HU) or PHI 320: Bioethics (HU)	EEE 334: Circuits II	MIC 420: Immunology: Molecular and Cellular Foundations or BIO 420: Immunology: Molecular and Cellular Foundations
BIO 331: Animal Behavior	EEE 350: Random Signal Analysis	MKT 300: Marketing and Business Performance
BIO 340: General Genetics or MBB 347: Molecular Genetics: From Genes to Proteins	EEE 352: Properties of Electronic Materials	MKT 370: Professional Sales and Relationship Management
BIO 345: Evolution	EEE 407: Digital Signal Processing	MKT 390: Essentials of Marketing
BIO 355: Introduction to Computational Molecular Biology (CS) or MAT 355: Introduction to Computational Molecular Biology (CS) or MBB 355: Introduction to Computational Molecular Biology (CS)	EEE 480: Feedback Systems	MKT 391: Essentials of Selling
BIO 360: Animal Physiology	EEE 481: Computer-Controlled Systems	MSE 301: Materials and Civilization
	ENT 305: Principles of Entrepreneurship	MSE 330: Thermodynamics of Materials
	FIN 300: Fundamentals of Finance	
	FIN 380: Personal Financial Management	
	FSE 301: Entrepreneurship and Value Creation or ENT 360: Entrepreneurship and Value Creation	

BIO 440: Functional Genomics or MBB 440: Functional Genomics	HCR 350: Introduction to Clinical Research	MSE 335: Materials Kinetics
BIO 451: Cell Biotechnology: Cell Culture, Immunocytochemistry and Bioimaging	IEE 300: Economic Analysis for Engineers	MSE 355: Structure and Defects
BIO 467: Neurobiology	IEE 320: Extreme Excel	MSE 356: Thin Film and Microelectronic Devices Lab
BME 394: Honors Research	IEE 369: Work Analysis and Design (L)	MSE 415: Mathematical and Computer Methods in Materials (CS)
BME 394: SBHSE Research Projects	IEE 381: Lean Six Sigma Methodology	MSE 420: Advanced Metallurgical Alloys and Processes
BME 492: Honors Directed Study	IEE 431: Engineering Administration (L)	MSE 421: Physical Metallurgy Laboratory
BME 493: Honors Thesis (L)	IND 464: Collaborative Design Development I (L)	MSE 440: Mechanical Behavior of Materials
BMI 311: Modeling Biomedical Knowledge	IND 465: Collaborative Design Development II (L)	MSE 442: Fatigue, Fracture, and Creep of Materials
BMI 465: Introduction to Comparative Genomics	KIN 334: Functional Anatomy and Kinesiology	MSE 450: Introduction to Materials Characterization
BUA 380: Small Business Leadership	KIN 340: Physiology of Exercise	MSE 451: Nanomaterials and Electronics Characterization Lab
BUA 381: Small Business Accounting and Finance	KIN 412: Biomechanics of the Skeletal System	MSE 458: Electronic, Magnetic, and Optical Properties
BUA 383: Small Business Working Relationships	KIN 413: Qualitative Analysis in Sport Biomechanics	MSE 460: Nanomaterials in Energy Production and Storage
BUS 384: Business Operations and Planning	KIN 414: Electromyographic Kinesiology (L)	MSE 470: Polymers and Composites
CEE 384: Numerical Methods for Engineers (CS) or MAE 384: Advanced Mathematical Methods for Engineers (CS)	KIN 440: Exercise Biochemistry	MSE 471: Introduction to Ceramics
CHE 475: Biochemical Engineering	LES 305: Business Law and Ethics for Managers	MSE 482: Materials Engineering Design (L)
CHM 302: Environmental Chemistry	LES 380: Consumer Perspective of Business Law	NTR 457: Sports Nutrition
CHM 325: Analytical Chemistry	LSC 347: Fundamentals of Genetics	PAF 301: Applied Statistics (CS)
CHM 326: Advanced Analytical Chemistry Laboratory	MAE 318: System Dynamics and Control I	PAF 410: Building Leadership Skills (SB)
CHM 341: Elementary Physical Chemistry or BCH 341: Physical Chemistry with a Biological Focus	MAE 341: Mechanism Analysis and Design	PHI 306: Applied Ethics (HU)
CIS 300: Web Design and Development	MAE 417: System Dynamics and Control II	PHI 313: Probability, Evidence, and Decision
COM 312: Communication, Conflict, and Negotiation	MAT 300: Mathematical Structures (L)	PHY 361: Introductory Modern Physics
CSE 310: Data Structures and Algorithms	MAT 310: Introduction to Geometry	PSY 325: Physiological Psychology
CSE 340: Principles of Programming Languages	MAT 342: Linear Algebra or MAT 343: Applied Linear Algebra	PSY 470: Psychopharmacology
CSE 412: Database Management	MAT 451: Mathematical Modeling (CS)	SCM 300: Global Supply Operations
DAT 301: Exploring Data in R and Python	MAT 460: Vector Calculus	SOC 334: Technology and Society (L or SB)
ECN 306: Survey of International Economics (SB & G)	MAT 462: Applied Partial Differential Equations	STP 421: Probability
	MBB 343: Genetic Engineering and Society (L) or BIO 343: Genetic Engineering and Society (L)	STP 429: Applied Regression (CS)
		STS 304: Science, Technology and Society (SB)
		STS 332: Global Issues in Science and Technology (SB)
		TEM 330: Systems Innovation

Notes:

- **First-Year Composition:** All students are placed in ENG 101 unless submission of SAT, ACT, Accuplacer, IELTS, or TOEFL score, or college-level transfer credit or test credit equivalent to ASU's first-year composition course(s), determine otherwise. Students on Polytechnic, Downtown Phoenix and West Campuses are encouraged to complete the Directed Self-Placement survey to choose the first-year composition option they believe best suits their needs. Visit: <https://cisa.asu.edu/DSP>
- **Mathematics Placement Assessment** score determines placement in first mathematics course.

Total Hours: 120

Upper Division Hours: 45 minimum

Major GPA: 2.00 minimum

Cumulative GPA: 2.00 minimum

Total hrs at ASU: 30 minimum

Hrs Resident Credit for

Academic Recognition: 56 minimum

Total Community College Hrs: 64 maximum

General University Requirements Legend

General Studies Core Requirements:

- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Arts and Design (HU)
- Social-Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

General Studies Awareness Requirements:

- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

First-Year Composition

General Studies designations listed on the major map are current for the 2021 - 2022 academic year.

From: [Tamiko Azuma](#)
To: [Jessica Meeker](#)
Cc: [Kate Lehman](#)
Subject: FW: Request for Letter of Support
Date: Monday, February 17, 2020 5:23:51 PM

Dear Jessica,

Our program coordinators have reviewed The School of Biological and Health Systems Engineering (SBHSE)'s proposal for to establish two concentrations in their undergraduate program (biomedical devices and another in biological devices). We confirm that these new concentrations will not have a negative impact on our BMI programs. Please let me know if you required any additional information.

Sincerely,
Tamiko

Tamiko Azuma, PhD

Assistant Dean of Undergraduate Education
Associate Professor of Speech and Hearing Science
Arizona State University | College of Health Solutions
Tempe: Coor Hall 3476 | Downtown: Health North Room 508B
tamiko.azuma@asu.edu | chs.asu.edu



From: Marcela Aliste <Marcela.Alistegomez@asu.edu>
Sent: Thursday, February 13, 2020 9:04 AM
To: Tamiko Azuma <TAMIKO.AZUMA@asu.edu>
Subject: RE: Request for Letter of Support

To Whom May Concern,

The Academic Program Committee of Biomedical Informatics at the College of Health Solutions reviewed the new proposal for the undergraduate concentration in biomedical devices, and offer its support for this new concentration.

Regards

Marcela Aliste

Marcela P. Aliste, MS, PhD
Academic Program Lead and Lecturer
Biomedical Informatics and Biomedical Diagnosis
Arizona State University | College of Health Solutions
Mayo Clinic, Samuel C. Johnson Research Bldg.

13212 E. Shea Blvd, Scottsdale, AZ 85259
Phone: 480-884-0233 | malisteg@asu.edu | chs.asu.edu



From: Tamiko Azuma
Sent: Tuesday, February 11, 2020 3:49 PM
To: Marcela Aliste <Marcela.Alistegomez@asu.edu>
Subject: RE: Request for Letter of Support

When you have reviewed them, please send me a formal message that I can pass on to the appropriate people.

Thank you!

Tamiko

From: Marcela Aliste <Marcela.Alistegomez@asu.edu>
Sent: Tuesday, February 11, 2020 2:58 PM
To: Tamiko Azuma <TAMIKO.AZUMA@asu.edu>
Subject: RE: Request for Letter of Support

Of course.

From: Tamiko Azuma
Sent: Tuesday, February 11, 2020 2:57 PM
To: Marcela Aliste <Marcela.Alistegomez@asu.edu>
Subject: FW: Request for Letter of Support

Hi Marcela,

Can you review these documents and confirm that this concentration will not negatively impact your programs?

Thanks,
Tamiko

From: Kate Lehman <KATE.LEHMAN@asu.edu>

Sent: Tuesday, February 11, 2020 10:16 AM

To: Julie Liss <JULIE.LISS@asu.edu>; Tamiko Azuma <TAMIKO.AZUMA@asu.edu>

Subject: FW: Request for Letter of Support

Hello:

This concentration does not appear to negatively impact the College of Health Solutions. Can one of you send a letter of support?

Thanks,

Kate Lehman

Senior Director Academic Affairs and Innovation

Academic Integrity Officer

Arizona State University | College of Health Solutions

550 N. 3rd Street, Phoenix, AZ 85004 | Health North Room 514

602-496-0241 | kate.lehman@asu.edu | chs.asu.edu



From: Jessica Meeker <Jessica.Meeker@asu.edu>

Sent: Monday, February 10, 2020 5:51 PM

To: Kate Lehman <KATE.LEHMAN@asu.edu>

Cc: Sergio Quiros <Sergio.Quiros@asu.edu>

Subject: Request for Letter of Support

Hello Kate,

I wanted to touch base on my request below. Is the College of Health Solutions able to provide a letter of support for the undergraduate concentration in biomedical devices?

Kind Regards,

Jessica

Jessica Meeker

Assistant Director, Academic Services

School of Biological and Health Systems Engineering

Ira A. Fulton Schools of Engineering

Arizona State University

Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Jessica Meeker
Sent: Wednesday, January 15, 2020 5:56 PM
To: Kate Lehman <KATE.LEHMAN@asu.edu>; Stacey Kimbell <kimbell@asu.edu>
Cc: Sergio Quiros <Sergio.Quiros@asu.edu>
Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello Kate and Stacey,

The School of Biological and Health Systems Engineering (SBHSE) is seeking approval to establish two concentrations within our currently existing undergraduate program—one in biomedical devices and another in biological devices.

For the biomedical devices concentration, it was recommended that we seek letters of support from CHS and from CISA. I've attached the original proposal, major map, and assessment documents.

Can you confirm if my request for the letter of support will suffice, or if I should have the BME undergraduate program chair reach out to someone in your office? If additional information is needed, please let me know.

Kind Regards,
Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Sergio Quiros <Sergio.Quiros@asu.edu>
Sent: Monday, November 25, 2019 2:25 PM
To: Jessica Meeker <Jessica.Meeker@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Jessica,

Please see highlights below.

Thank you,

Sergio Quiros

Specialist Senior, Academic, and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

From: Jessica Meeker <Jessica.Meeker@asu.edu>
Sent: Friday, November 22, 2019 1:01 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: Jessica Meeker <Jessica.Meeker@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Sergio,

I included some comments below. It seems all we're missing are the recommended letters of support and possibly the modify course forms to include the concentrations in the pre-reqs, correct?

Kind Regards,
Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Beth Landish <Beth.Landish@asu.edu>
Sent: Monday, July 02, 2018 9:16 AM
To: Jennifer Shea <jdshea@asu.edu>; Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Sergio,

That works. Enrollment requirements are long enough! 😊

Thanks,
Beth

Beth A. Landish

Assistant Director, Curricular Activities and Actions
Office of the University Provost
Arizona State University

From: Jennifer Shea
Sent: Friday, June 29, 2018 4:24 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>; Beth Landish <Beth.Landish@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi, Sergio! I am forwarding your question to April and Beth for clarification. - JShea

From: Sergio Quiros
Sent: Friday, June 29, 2018 4:09 PM
To: Curriculum Planning <CurriculumPlanning@exchange.asu.edu>
Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>;
Jeremy Helm <JEREMY.HELM@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello Jennifer,

With regards to the prerequisite issue, our plan was to request that the new plancodes be added to the existing enrollment requirement group (001761) and keep the text "Biomedical Engineering major" the same. Is this sufficient? Or do you want us to specifically name all three plans in the enrollment requirements?

Thank you,

Sergio Q. Quiros

Specialist Senior, Academic and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

From: Curriculum Planning

Sent: Friday, June 29, 2018 3:30 PM

To: Sergio Quiros <Sergio.Quiros@asu.edu>

Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>; Jeremy Helm <JEREMY.HELM@asu.edu>; Curriculum Planning <CurriculumPlanning@exchange.asu.edu>

Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello, Sergio,

Please find attached the provost office review of the following proposal:

Ira A. Fulton Schools of Engineering

School of Biological and Health Systems Engineering

Establishment of an undergraduate concentration

BSE in Biomedical Engineering (Biomedical Devices)

In addition to the comments on the proposal itself, I'd highlight the following:

- Please confirm your plans for the BSE in Biomedical Engineering. Will it become inactive once this concentration and the related biomedical devices concentration are implemented? See additional notes on page 2 of the proposal.
 - **Correct, the BSE in Biomedical Engineering would become inactive once the concentrations are approved/implemented.**
- We have some concerned about the lack of participatory buy-in from SoLS. As per an excerpt from an 11/05/17 email that Fred Corey sent to Kyle Squires and James Collofello: "Mark is going to be giving the green light on the concentration in Biological Devices and Biomedical Devices ... but he wants to be sure you are working with SoLS, particularly with Biological Devices. This will be important when the proposal goes to CAPC. He will be looking for something more engaging than "we do not object," and something more along the lines of participation."
 - **SOLS has agreed to participation and met with Dr. Vernon to discuss. Additionally, BIO 353 pre-requisites have been updated to include BME students.**
- We recommend obtaining letters of support from the College of Health Solutions and New College.
 - **Can you confirm if these have been received? I don't see them in the Dropbox folder for the concentrations. If not, I just want to confirm that I should email Kate Lehman and Stacey Kimbell for letters of support? Or does Dr. Vernon (our UG chair) email the faculty directly? Please reach out to Kate and Stacey.**
- Many of the course prerequisites are limited to "Biomedical Engineering major," which specifically points to the parent plan code. Modify Course Forms are needed for 22 courses in order to add the concentration into the prerequisites. A full list of affected courses appears in the proposal. *Please resubmit this proposal only after those forms are at the University Review level in ChangeMaker.*

- Our plan was to request that the new plancodes be added to the existing enrollment requirement group (001761) and keep the text "Biomedical Engineering major" the same. Will that suffice? Yes, I added Beth's confirmation above (7/2/2019 email).
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 - STP 326 was removed from one of the tracks in the "Upper Division Related Elective" because it was inactivated in the catalog cleanup. Thank you!
 - In the Biomechanics track, there's a little "or" between MAE 341 and FSE 301. Those courses don't seem related – should this instead be a big "OR"? Updated on fall 2020 map.
 - A Term 3 note for the "Resume, Presentation, and Resource Library" URL leads to "Page Not Found" - <https://career.engineering.asu.edu/develop-personal-toolkit/>. Updated on fall 2020 map.
 - The major map lists CHM 116 as an alternative to CHM 114, but CHM 116 is not listed on the proposal. Also, the prerequisites aren't met on the major map for CHM 116. Updated on fall 2020 map.
 - There needs to be a note in Term 6 regarding the Related Area Electives. It appears in a later term with the link to your website and then an Excel spreadsheet of courses. We would like to see more direction on how students select their Related Area and if they must take all nine hours within one area, etc. We'd also like to see that type of note repeated at the track/group level for clarity. Updated on fall 2020 map.

The next possible governance meetings occur in August 2018. For this proposal to make those meetings, it would need to be submitted - with no additional revisions necessary - by July 27, 2018. Can you confirm the next meeting date? And just so I understand, I should add the updated documents to the dropbox folder or do I email them to you directly? Once all the information is received please respond to this email to keep it all in one thread. The meetings deadlines will vary based on when we received the letters of support.

Please let me know if you have any questions. We look forward to reviewing the revised submission.

Sincerely,
Jennifer

Jennifer D. Shea, PhD

Manager, Curriculum Development
Office of the University Provost
Arizona State University
Phone: (480) 727-8634
jdshea@asu.edu

From: Sergio Quiros

Sent: Monday, June 4, 2018 10:29 AM

To: Curriculum Planning <CurriculumPlanning@exchange.asu.edu>

Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>;
Jeremy Helm <JEREMY.HELM@asu.edu>

Subject: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello,

Attached for your review is the following proposal:

-
Ira A. Fulton Schools of Engineering
School of Biological and Health Systems Engineering
Establishment of an Undergraduate Concentration
BSE in Biomedical Engineering (Biomedical Devices)

Best,

Sergio Quiros

Specialist Senior, Academic and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

From: Stacey Kimbell <kimbell@asu.edu>
Sent: Thursday, January 16, 2020 8:57 AM
To: Jessica Meeker <Jessica.Meeker@asu.edu>
Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Good morning Jessica,

On behalf of Associate Dean Patricia Friedrich and School of Mathematical and Natural Sciences Director Lara Ferry, New College is happy to support your proposal to establish this concentration. Please let us know if you need anything further related to this request.

Sincerely,
Stacey

Stacey Kimbell
Executive Assistant to the Vice Provost and Dean
Todd Sandrin
New College | Arizona State University
P.O. Box 37100, M/C 1251
Phoenix, AZ 85069-7100
602-543-6150
skimbell@asu.edu

Students: Please include your 10-digit ASU ID number in all email communications.

Confidentiality Notice: This e-mail message, including attachments, is for the sole use of the intended recipients and may contain confidential and privileged information. Any unauthorized review, use, disclosure or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message.

From: Jessica Meeker
Sent: Wednesday, January 15, 2020 5:56 PM
To: Kate Lehman <KATE.LEHMAN@asu.edu>; Stacey Kimbell <kimbell@asu.edu>
Cc: Sergio Quiros <Sergio.Quiros@asu.edu>
Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello Kate and Stacey,

The School of Biological and Health Systems Engineering (SBHSE) is seeking approval to establish two concentrations within our currently existing undergraduate program—one in biomedical devices and another in biological devices.

For the biomedical devices concentration, it was recommended that we seek letters of support from CHS and from CISA. I've attached the original proposal, major map, and assessment documents.

Can you confirm if my request for the letter of support will suffice, or if I should have the BME undergraduate program chair reach out to someone in your office? If additional information is needed, please let me know.

Kind Regards,
Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: [Stacey Kimbell](#)
To: [Jessica Meeker](#)
Cc: [Sergio Quiros](#)
Subject: FW: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)
Date: Tuesday, October 13, 2020 8:38:55 AM
Attachments: [image001.png](#)

Good morning Jessica,

New College has no issues with this proposal and fully supports it.

Thanks!
Stacey

Stacey Kimbell

Executive Administrative Support Specialist and Curriculum Coordinator

New College | Arizona State University

P.O. Box 37100, M/C 1251

Phoenix, AZ 85069-7100

602-543-6150

skimbell@asu.edu

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From: Patricia Friedrich <Patricia.Friedrich@asu.edu>
Sent: Tuesday, October 13, 2020 8:32 AM
To: Stacey Kimbell <kimbell@asu.edu>
Subject: Re: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)

I have no problems with this. Thank you, Patty

Patricia Friedrich, PhD

She, Her, Hers

Associate Dean of Academic Programs and Faculty Affairs,

New College of Interdisciplinary Arts and Sciences

Professor of Sociolinguistics,

School of Social and Behavioral Sciences



Arizona State University

P. O. Box 37100

4701 W. Thunderbird Rd. Mail Code 3051

Phoenix, AZ, USA 85069-7100

voice 602 543-6046

From: Stacey Kimbell <kimbell@asu.edu>

Date: Tuesday, October 13, 2020 at 8:17 AM

To: Patricia Friedrich <Patricia.Friedrich@asu.edu>

Subject: FW: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)

Hi Patty,

Please see the request for impact statement below; MNS has no issues with the proposal. Please review and let me know if you also approve.

Sincerely,
Stacey

Stacey Kimbell

Executive Administrative Support Specialist and Curriculum Coordinator

New College | Arizona State University

P.O. Box 37100, M/C 1251

Phoenix, AZ 85069-7100

602-543-6150

skimbell@asu.edu

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From: James Sulikowski <James.Sulikowski@asu.edu>

Sent: Monday, October 12, 2020 3:42 PM

To: Stacey Kimbell <kimbell@asu.edu>; Vernon Morris <Vernon.Morris@asu.edu>

Subject: Re: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)

Hi Stacey-

Both our Math and natural Science area heads found no issues or concerns.

Best Wishes
James

Dr. James Sulikowski
Professor and Associate Director

New College of Interdisciplinary Arts & Sciences
School of Mathematical & Natural Sciences

Arizona State University

Phone: 602 543 1214

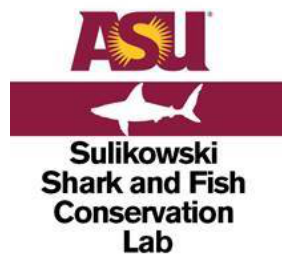
ASU Profile: <https://isearch.asu.edu/profile/3511611>

Website: <https://sites.google.com/view/sulikowskilab/home>

Social Media: @sulikowskilab

Address: [4701 W. Thunderbird Road](#) - M/C 2352

[Glendale, AZ 85306](#)



From: Stacey Kimbell <kimbell@asu.edu>

Date: Saturday, October 10, 2020 at 2:07 PM

To: James Sulikowski <James.Sulikowski@asu.edu>

Subject: FW: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)

Good afternoon James,

Please see the request for statement of support for the proposed BSE Biomedical Engineering (Biological Devices). If you have no concerns or objections to this proposal, please let me know and I'll communicate with Jessica. If you do have any concerns, you would want to engage with Brent Vernon, the originator of the proposal. Please let me know how you would like to proceed.

Sincerely,
Stacey

Stacey Kimbell

Executive Administrative Support Specialist and Curriculum Coordinator

New College | Arizona State University

P.O. Box 37100, M/C 1251

Phoenix, AZ 85069-7100

602-543-6150

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From: Jessica Meeker <Jessica.Meeker@asu.edu>
Sent: Saturday, October 10, 2020 2:01 PM
To: Stacey Kimbell <kimbell@asu.edu>
Cc: Sergio Quiros <Sergio.Quiros@asu.edu>
Subject: Request for Letter of Support - BSE in Biomedical Engineering (BIOLOGICAL Devices)

Hello Stacey,

Thank you for facilitating the previously requested letters of support from New College for SBHSE's proposed concentration in Biomedical Devices for our undergraduate Biomedical Engineering BSE degree.

The Provost's office is now asking that we also seek New College's support for our second proposed concentration in Biological Devices (also part of our undergraduate Biomedical Engineering BSE degree) due to the Biotechnology and Bioenterprise BS program.

I've attached the original proposal, major map, and assessment documents for the Biological Devices concentration.

Can you confirm if my request for the letter of support will suffice, or if I should have the BME undergraduate program chair reach out to someone in your office? If additional information is needed, please let me know.

Kind Regards,
Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>

Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Stacey Kimbell <kimbell@asu.edu>

Sent: Thursday, January 16, 2020 8:57 AM

To: Jessica Meeker <Jessica.Meeker@asu.edu>

Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Good morning Jessica,

On behalf of Associate Dean Patricia Friedrich and School of Mathematical and Natural Sciences Director Lara Ferry, New College is happy to support your proposal to establish this concentration. Please let us know if you need anything further related to this request.

Sincerely,
Stacey

Stacey Kimbell

Executive Assistant to the Vice Provost and Dean
Todd Sandrin

New College | Arizona State University

P.O. Box 37100, M/C 1251

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Sent: Wednesday, January 15, 2020 5:56 PM

To: Kate Lehman <KATE.LEHMAN@asu.edu>; Stacey Kimbell <kimbell@asu.edu>

Cc: Sergio Quiros <Sergio.Quiros@asu.edu>

Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello Kate and Stacey,

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Can you confirm if my request for the letter of support will suffice, or if I should have the BME undergraduate program chair reach out to someone in your office? If additional information is needed, please let me know.

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Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

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Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Sergio Quiros <Sergio.Quiros@asu.edu>
Sent: Monday, November 25, 2019 2:25 PM
To: Jessica Meeker <Jessica.Meeker@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Jessica,

Please see highlights below.

Thank you,

Sergio Quiros

Specialist Senior, Academic, and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

From: Jessica Meeker <Jessica.Meeker@asu.edu>
Sent: Friday, November 22, 2019 1:01 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: Jessica Meeker <Jessica.Meeker@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Sergio,

I included some comments below. It seems all we're missing are the recommended letters of support and possibly the modify course forms to include the concentrations in the pre-reqs, correct?

Kind Regards,
Jessica

Jessica Meeker
Assistant Director, Academic Services
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Beth Landish <Beth.Landish@asu.edu>
Sent: Monday, July 02, 2018 9:16 AM
To: Jennifer Shea <jdshea@asu.edu>; Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Sergio,

That works. Enrollment requirements are long enough! 😊

Thanks,
Beth

Beth A. Landish
Assistant Director, Curricular Activities and Actions
Office of the University Provost
Arizona State University

From: Jennifer Shea
Sent: Friday, June 29, 2018 4:24 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>; Beth Landish <Beth.Landish@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

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Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

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Jeremy Helm <JEREMY.HELM@asu.edu>; Curriculum Planning
<CurriculumPlanning@exchange.asu.edu>
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(Biomedical Devices)

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Ira A. Fulton Schools of Engineering

School of Biological and Health Systems Engineering
Establishment of an undergraduate concentration
BSE in Biomedical Engineering (Biomedical Devices)

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implemented? See additional notes on page 2 of the proposal.

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- We recommend obtaining letters of support from the College of Health Solutions and New College.
 - **Can you confirm if these have been received? I don't see them in the Dropbox folder for the concentrations. If not, I just want to confirm that I should email Kate Lehman and Stacey Kimbell for letters of support? Or does Dr. Vernon (our UG chair) email the faculty directly? Please reach out to Kate and Stacey.**
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Please let me know if you have any questions. We look forward to reviewing the revised submission.

Sincerely,
Jennifer

Jennifer D. Shea, PhD

Manager, Curriculum Development
Office of the University Provost
Arizona State University
Phone: (480) 727-8634
jdshea@asu.edu

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Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>;
Jeremy Helm <JEREMY.HELM@asu.edu>
Subject: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hello,

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Ira A. Fulton Schools of Engineering
School of Biological and Health Systems Engineering
Establishment of an Undergraduate Concentration
BSE in Biomedical Engineering (Biomedical Devices)

Best,

Sergio G. Quiros

Specialist Senior, Academic and Student Affairs
Ira A. Fulton Schools of Engineering

Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Ouiros@asu.edu

January 4, 2018

Re: Proposal to establish a new concentration, Biomedical Devices,
in the B.S.E. in Biomedical Engineering

Dear Colleague,

The faculty of the School of Biological and Health Systems Engineering (SBHSE), in which the Biomedical Engineering degree programs are housed, are enthusiastically supportive of this proposed concentration in Biomedical Devices.

Governance procedures for curriculum changes in SBHSE require initial vetting and approval by the curriculum committee, which was obtained on May 31, 2017 at the annual curriculum retreat. Final approval was obtained from the entire faculty at a faculty meeting devoted to this topic on June 13, 2017. Approval from the SBHSE Industrial Advisory Board is not required, but we also described these proposed changes to the advisory board on May 16, 2017 – the advisory board was unanimously in favor.

SBHSE has the resources to support this concentration as presented in the proposal, without impacting core course resources. Current budgets should suffice and space already exists for this concentration because it is essentially identical to the current curriculum for the B.S.E. in Biomedical Engineering (establishment of this concentration is necessary because we are establishing a distinct concentration in Biological Devices at this time). Faculty to teach these courses and advise the students in this track are already employed by ASU's SBHSE.

Thank you for your consideration of this proposal.

Sincerely,



Michael R. Caplan, PhD

Associate Professor, Harrington Biomedical Engineering
School of Biological and Health Systems Engineering
Ira A. Fulton Schools of Engineering
Arizona State University
Email: Michael.Caplan@asu.edu
Phone: (480)965-5144



Brent Vernon, PhD
Associate Professor, BME
SBHSE
FSE
Arizona State University
email: brent.vernon@asu.edu
Phone: (480)352 6926

DATE: April 3, 2018

FROM: Marco Santello, School of Biological and Health Systems Engineering

TO: Sergio Quiros, Specialist Senior, Academic and Student Affairs, Ira A. Fulton Schools of Engineering

To Whom It May Concern:

I support the proposal to establish undergraduate concentrations of (1) BSE in Biomedical Engineering (Biological Devices) and (2) BSE in Biomedical Engineering (Biomedical Devices).

We hope this will help with both our recruitment and retention of students.

Best regards,



Marco Santello, PhD
Harrington Endowed Chair and Professor
Director, School of Biological and Health Systems Engineering
Director, NSF I/UCRC BRAIN
Arizona State University

From: [Paul LePore](#)

Sent: Friday, June 1, 2018 12:27 PM

To: [James Collofello](#)

Cc: [Paul LePore](#)

Subject: FOLLOW-UP -- Request for impact statement on proposed BME Concentration in "Biological Devices"

Here you go Jim.

Best,

PL

PAUL C. LEPORE, Ph.D.

Associate Dean

College of Liberal Arts and Sciences

Armstrong Hall, Suite 152-H

Arizona State University | P.O. Box 872601 | Tempe, Arizona 85287-2601

480.965.6506 | Fax: 480.965.2110 | e-mail: paul.lepore@asu.edu

ASU College of Liberal Arts and Sciences — *First Year Forward*

From: Michael Angilletta <ma@asu.edu>

Date: Monday, April 30, 2018 at 12:24 PM

To: Ferran Garcia-Pichel <ferran@asu.edu>, Bertram Jacobs <bjacobs@asu.edu>

Subject: RE: Request for impact statement on proposed BME Concentration in "Biological Devices"

Ferran,

SOLS does not object to this proposed degree. We can accommodate the increase in enrollment in BIO 353.

Best,

Mike

From: Michael Caplan <Michael.Caplan@asu.edu>

Date: Friday, April 20, 2018 at 3:20 PM

To: Ferran Garcia-Pichel <ferran@asu.edu>

Cc: James Collofello <JAMES.COLLOFELLO@asu.edu>, Jeffrey Kleim <jakleim@asu.edu>, Sergio Quiros <Sergio.Quiros@asu.edu>, Keli Palmer Greenhagen <Keli.Palmer@asu.edu>, Michael Angilletta <ma@asu.edu>

Subject: Request for impact statement on proposed BME Concentration in "Biological Devices"

Dean Garcia-Pichel,

Biomedical Engineering (for which I'm undergrad Program Chair) is proposing two concentrations – one in “biomedical devices” and another in “biological devices”. The one in biological devices is designed to prepare our students for working for companies that make devices that would be classified by the US Food and Drug Administration as “biological products”. These can include stem cell therapies, gene therapies, programming the immune system to target cancer, immuno-histochemical diagnostics, blood-contacting materials, controlled-release therapeutics, and local delivery of therapeutics. I've attached the full proposal in case you want to read the details.

In putting forward this application, we would very much appreciate a short letter of support from you, as the Dean of the College of Natural Sciences. The instructions in section 1B say “Identify other related ASU programs and outline how the new concentration will complement these existing ASU programs,” and in section 3C say “Letters of support must be included from all academic units that will commit resources to this concentration.” I originally asked Mike Angilletta for this letter, but he wanted me to ask you instead.

I believe the complementarity is in BME students taking the BIO353 class, offering our BME courses in this concentration to SOLS students as potential electives, cross-pollination of students working in research labs through students interacting with faculty teaching these classes, and hopefully renewed BME participation in BIO451 (which was originally co-developed by BME and SOLS faculty when it was first taught in ~2002). The SOLS resources committed are entirely due to the additional enrollment in BIO353. I exchanged emails with David Capco and Robert Roberson (the instructors of BIO353) earlier this year, and they said that they were fine with the increased enrollment with the proviso that, “if more students (60 – 80) were to enroll, we would need support from SoLS (TAs) and ASU (larger class room or split class into two sections).” We are estimating that approximately 60 BME students per year will want to participate in this track, and thus would need to take BIO353.

Would you be willing to write a short letter of support for this concentration? If you have questions or concerns, I would be happy to either talk by phone or meet in person to discuss. I'm copying Jeff Kleim, Associate Director of SBHSE, on this email and I'm sure Jeff would be happy to talk with us if your questions or concerns are more administrative (e.g., money) than curricular.

Thank you very much,
Michael Caplan
Associate Professor and Program Chair
Harrington Biomedical Engineering
Arizona State University

From: [Jenny Smith](#)
To: [Jessica Meeker](#)
Cc: [Sergio Quiros](#)
Subject: FW: FOLLOW-UP -- IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)
Date: Wednesday, January 29, 2020 8:28:58 AM

Jessica,

Below is the statement of collaboration and impact you requested from our college for the proposed BSE in Biomedical Engineering (Biological Devices).

Let us know if you need additional information.

Jenny

JENNY SMITH

Executive Administrative Support Specialist
The College of Liberal Arts and Sciences
Arizona State University | P.O. Box 872601 | Tempe, Arizona 85287-2601
480.965.6506 | Fax: 480.965.2110 | e-mail: jenny.smith@asu.edu

From: Paul LePore <Paul.Lepore@asu.edu>
Sent: Wednesday, January 29, 2020 8:16 AM
To: Jenny Smith <jenny.smith@asu.edu>
Cc: Paul LePore <Paul.Lepore@asu.edu>
Subject: FOLLOW-UP -- IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Jenny can you share with the folks below? Thanks! PL

School of Life Sciences

The School of Life Sciences does not see any conflict with the proposed degree program. SOLS can accommodate the increase in enrollment in BIO 181 and BIO 353.

From Physics:

Physics has no conflict, and has possible benefit to list 2 courses from our “new” BioPhys BS as electives, per below. These are:

- PHY 371: Driving Forces in Biology – Ozkan
- PHY472: Advanced Biophysics Lab – Hariadi.

School of Molecular Sciences:

The School of Molecular Sciences (SMS) envisions no negative impact on our current courses from the proposed new concentration in Biological Devices associated with the BSE Biomedical Engineering. SMS can accommodate increased enrollments in our CHM 114, CHM 231, CHM 235, CHM 233 and CHM 237 courses. Students in this concentration would find

interest and possible research opportunities for SMS faculty who work in several areas, from microfluidic separation at the cellular level and detection of biomolecules at the single molecule level.

PAUL C. LEPORE, Ph.D.

Associate Dean

The College of Liberal Arts and Sciences

Armstrong Hall, Suite 152-H

1100 South McAllister Avenue

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ASU College of Liberal Arts and Sciences — *First Year Forward*

From: Jessica Meeker <Jessica.Meeker@asu.edu>

Sent: Wednesday, January 15, 2020 6:04 PM

To: Jenny Smith <jenny.smith@asu.edu>

Cc: Sergio Quiros <Sergio.Quiros@asu.edu>

Subject: FW: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Hello Jenny,

The School of Biological and Health Systems Engineering (SBHSE) is seeking approval to establish two concentrations within our currently existing undergraduate program—one in biomedical devices and another in biological devices.

For the biological devices concentration, it was recommended that we seek a letter of support from the School of Life Sciences. I've attached the original proposal, major map, and CLAS statement of support previously received. However, a new letter is needed detailing the extent of the collaboration.

Can you confirm if my request for the letter of support will suffice, or if I should have the BME undergraduate program chair (Dr. Vernon) reach out to someone in your office? Please also let me know if any additional information is needed.

Thank you!

Kind Regards,

Jessica

Jessica Meeker

Assistant Director, Academic Services

School of Biological and Health Systems Engineering

Ira A. Fulton Schools of Engineering

Arizona State University

Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>

Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Sergio Quiros <Sergio.Quiros@asu.edu>

Sent: Monday, November 25, 2019 2:36 PM

To: Jessica Meeker <Jessica.Meeker@asu.edu>

Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Hi Jessica,

Just letters for this one. See highlights below.

Sergio Q. Quiros

Specialist Senior, Academic, and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Quiros@asu.edu

From: Jessica Meeker <Jessica.Meeker@asu.edu>

Sent: Friday, November 22, 2019 1:48 PM

To: Sergio Quiros <Sergio.Quiros@asu.edu>

Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Hi Sergio,

For this one, same items needed—letters and modify course forms only, correct? Or am I to have Dr. Vernon also re-do the actual proposal that Dr. Caplan submitted? Thank you for all of your help on this.

Kind Regards,

Jessica

Jessica Meeker

Assistant Director, Academic Services

School of Biological and Health Systems Engineering

Ira A. Fulton Schools of Engineering

Arizona State University

Jessica.Meeker@asu.edu

Schedule an advising appointment online: <https://fultonapps.asu.edu/advising>
Visit the SBHSE website: <http://sbhse.engineering.asu.edu>

From: Beth Landish <Beth.Landish@asu.edu>
Sent: Monday, July 02, 2018 9:16 AM
To: Jennifer Shea <jdshea@asu.edu>; Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi Sergio,

That works. Enrollment requirements are long enough! 😊

Thanks,
Beth

Beth A. Landish

Assistant Director, Curricular Activities and Actions
Office of the University Provost
Arizona State University

From: Jennifer Shea
Sent: Friday, June 29, 2018 4:24 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: April Randall <April.Randall@asu.edu>; Beth Landish <Beth.Landish@asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biomedical Devices)

Hi, Sergio! I am forwarding your question to April and Beth for clarification. - JShea

From: Curriculum Planning <CurriculumPlanning@exchange.asu.edu>
Sent: Friday, June 29, 2018 4:25 PM
To: Sergio Quiros <Sergio.Quiros@asu.edu>
Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>; Jeremy Helm <JEREMY.HELM@asu.edu>; Curriculum Planning <CurriculumPlanning@exchange.asu.edu>
Subject: RE: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Hello, Sergio,

Please find attached the provost office review of the following proposal:

Ira A. Fulton Schools of Engineering

School of Biological and Health Systems Engineering
Establishment of an undergraduate concentration
BSE in Biomedical Engineering (Biological Devices)

In addition to the comments on the proposal itself, I'd highlight the following:

- We are concerned about the lack of participatory buy-in from SoLS. As per an excerpt from an 11/05/17 email that Fred Corey sent to Kyle Squires and James Collofello: "Mark is going to be giving the green light on the concentration in Biological Devices and Biomedical Devices ... but he wants to be sure you are working with SoLS, particularly with Biological Devices. This will be important when the proposal goes to CAPC. He will be looking for something more engaging than "we do not object," and something more along the lines of participation."
 - SOLS has agreed to participation and met with Dr. Vernon to discuss. Additionally, BIO 353 pre-requisites have been updated to include BME students. Is a new impact statement needed? Yes, a new statement describing the extent of collaboration is needed.
- Several Modify Course Forms are needed to add this concentration into the prerequisites. A full list (slightly different than the Biomedical Devices concentration) appears in the proposal. *Please resubmit this proposal only after those forms are at the University Review level in ChangeMaker.*
 - Our plan was to request that the new plancodes be added to the existing enrollment requirement group (001761) and keep the text "Biomedical Engineering major" the same. Will that suffice? Yes, I added Beth's confirmation above (7/2/2019 email).
- On the major map we made editorial tweaks/corrections and fixed some formatting issues. An updated major map is attached. Other issues related to the major map appear below.
 - The major map has CHM 116 as an alternative to CHM 114, but CHM 116 isn't on the proposal. The prerequisites for CHM 116 aren't met on the major map, either. Updated for fall 2020.
 - The major map lists CHM 233 & 237 as alternatives to CHM 231 & 235, but they aren't on the proposal. CHM 233/237 removed for fall 2020.
 - The prerequisites for BIO 353 aren't met on the major map. It needs BIO 182 somewhere on the map as well. Pre-requisites updated effective spring 2020.
 - On the major map, 3 credits of "Upper Division Related Elective" are broken out and paired with the Upper Division Literacy requirement. This is no longer needed since BME 490 gained the L designation. The major map should be updated to match the proposal in that area. Updated for fall 2020.
 - In the Biomechanics track, MAE 341 and FSE 301 have a little "or" between them that doesn't seem right. I believe it should be a big OR. Updated for fall 2020.
 - The Pre-Medical track contains BIO 353, which should be removed if BIO 353 will remain a required course in a term. Updated for fall 2020.
 - In Term 3, the link for the "Resume, Presentation, and Resource Library" leads to

"Page Not Found" - <https://career.engineering.asu.edu/develop-personal-toolkit/> Updated for fall 2020.

- We removed STP 326 from a track/group since the course was inactivated in the purge. Thank you!
- We would like to see better term notes regarding the Related Area electives that provide more direction. We also would like to see that note repeated at the track/group level, as well. Updated for fall 2020.

The next possible governance meetings occur in August 2018. For this proposal to make those meetings, it would need to be submitted - with no additional revisions necessary - by July 27, 2018.

Please let me know if you have any questions. We look forward to reviewing the revised submission.

Sincerely,
Jennifer

Jennifer D. Shea, PhD

Manager, Curriculum Development
Office of the University Provost
Arizona State University
Phone: (480) 727-8634
jdshea@asu.edu

From: Sergio Quiros

Sent: Monday, June 4, 2018 10:29 AM

To: Curriculum Planning <CurriculumPlanning@exchange.asu.edu>

Cc: Michael Caplan <Michael.Caplan@asu.edu>; Keli Palmer Greenhagen <Keli.Palmer@asu.edu>;
Jeremy Helm <JEREMY.HELM@asu.edu>

Subject: IFSE Proposal to establish UG Concentration - BSE in Biomedical Engineering (Biological Devices)

Hello,

Attached for your review is the following proposal:

Ira A. Fulton Schools of Engineering

School of Biological and Health Systems Engineering
Establishment of an Undergraduate Concentration
BSE in Biomedical Engineering (Biological Devices)

Best,

Sergio J. Quiros

Specialist Senior, Academic and Student Affairs
Ira A. Fulton Schools of Engineering
Arizona State University

Tempe, AZ 85287-8109
Phone: 480/727-5770
Email: Sergio.Ouiros@asu.edu