

**Volgenau School of Engineering - Bioengineering, BS  
with Concentration in Healthcare Informatics**

Catalog Year: 2019 - 2020		Grades		
Mason Core Reqs (21 credits)	Course Information	Credits	Earned	Needed
Written Communication:	ENGH 101 (100)	3		
*Oral Communication	*Satisfied by Major Requirements			
*Quantitative Reasoning	*Satisfied by Major Requirements			
*Information Technology	*Satisfied by Major Requirements			
Arts		3		
Global Understanding		3		
Literature		3		
*Natural Science	*Satisfied by Major Requirements			
*Social & Behavioral Science	Choose from: PSYC 100, ECON 103, SOCI 101	3		
Western Civ/World History		3		
**Written Communication	ENGH 302 - **Natural Science Section Only	3		
*Capstone/Synthesis	*Satisfied by Major Requirements			
<b>Major Requirements (103 credits)</b> Students must complete each BENG, BIOL, CHEM, CS, ECE, ME course presented as part of the required credits for the degree with a grade of C or better				
<b>Bioengineering Requirements (43 credits)</b>		Credits	Earned	Needed
BENG 101	Introduction to Bioengineering	3		
BENG 214	Physiology for Engineers	3		
BENG 230	Continuum Biomechanics and Transport I	3		
BENG 240	Biomaterials	3		
BENG 241	Biomechanics and Biomaterials Laboratory	1		
BENG 320	Bioengineering Signals and Systems	3		
BENG 330	Computational Methods in Bioengineering	3		
BENG 331	Computational Methods in Bioengineering Laboratory	1		
BENG 350	Neural System Designs	3		
BENG 360	Biomedical Imaging	3		
BENG 370	Bioinstrumentation and Devices I	3		
BENG 371	Bioinstrumentation and Devices Laboratory	1		
BENG 391	Bioengineering Professional Development	1		
BENG 414	Pathophysiology & the Role of New Technologies in Human Diseases	3		
BENG 475	Intellectual Property, Regulatory Concepts and Product Development	3		
BENG 492	Senior Advanced Design Project I	3		
BENG 493	RS: Senior Advanced Design Project II	3		
<b>Additional Supporting Coursework (38 credits)</b>		Credits	Earned	Needed
BIOL 213	Cell Structure and Function (Bioengineering-specific section)	3		
CS 112	Introduction to Computer Programming	4		
MATH 113	Analytic Geometry and Calculus I	4		
MATH 114	Analytic Geometry and Calculus II (B- or better required)	4		
MATH 203	Linear Algebra	3		
MATH 213	Analytic Geometry and Calculus III (Bioengineering-specific section)	3		
MATH 214	Elementary Differential Equations (B- or better required)	3		
STAT 350	Introductory Statistics II	3		
PHYS 160/161 and 260/261	University Physics I & II	8		
COMM 100 or 101	Public Speaking or Fundamentals of Communication	3		
<b>Concentration in Healthcare Informatics (22 credits)</b>				
CHEM 271/272	General Chemistry for Engineers with Lab	4		
CHEM 310	Survey of Organic Chemistry	3		
HAP 360	Introduction to Health Information Systems	3		
HAP 361 or IT 214	Health Databases or Database Fundamentals	3		
HAP 464	Electronic Health Record Configuration and Data Analysis	3		
<b>Technical Electives (6 credits):</b> BENG 327, 390, 395, 413, 317, 420, 421, 426, 429, 430, 434, 435, 437, 438, 441, 451, 470, 487, 499, 501, 526, 538, 541, 550. May sub one technical elective with one from: CS 310; ECE 305; ECE 421; ME 313; BIOL 305/306; CHEM 313/315; PSYC 372; HAP 440, 459				
Technical Elective #1:		3		
Technical Elective #2:		3		



## Volgenau School of Engineering

### BIOENGINEERING, B.S.

2019 - 2020

Bioengineering, also referred to as biomedical engineering, is the application of engineering tools and approaches to solve problems in biology and medicine. It is a broad and growing field that draws upon rapid advances in technology and computation, as well as on unprecedented growth in basic biological understanding.

This program provides i) a scientific foundation in math, physics, biology, chemistry and physiology, ii) broad introductions to bioengineering technology platforms including medical imaging, devices, computational biomedicine, neurotechnology, biomaterials and nanomedicine followed by a deepening of knowledge in one of these areas through a concentration and iii) translational courses showing how new technologies can be implemented in clinical medicine and then commercialized by industry partners. Engineering design experiences are built into each year of the curriculum culminating in a senior design project. The impact of engineering, technologies and computer science on biomedicine is immense, and can only be harnessed through integrative multidisciplinary training in Bioengineering. With the growing demand for better health care, the need for bioengineers is high.

The multidisciplinary training in this field makes graduates competitive for positions in government and in biomedical industry. The BS in Bioengineering also enables students to continue their education in graduate school or medical school.

The bachelor's program in Bioengineering is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

#### **Degree Requirements**

The curriculum requires a minimum 122 total credit hours (with the exception of the BMPH concentration), which can be completed within eight semesters. At least 45 semester hours of the degree requirements must be at the 300 level or above. Students may wish to consider an extra semester or two for the purpose of lightening the course load (particularly for those with part-time employment); participating in Cooperative Education (with local industry); or adding extra courses to deepen their knowledge in engineering and/or the basic sciences.

#### **Concentrations**

Students choose one of six concentrations from the list provided: Computational Biomedical Engineering, Biomedical Imaging and Devices, Biomaterials and Nanomedicine, Neurotechnology and Computational Neuroscience, Bioengineering Health Care Informatics, and Bioengineering Prehealth. The first four concentrations are based on our department's research pillars.

# Bioengineering, BS

## 2019-2020 Sample Schedule for BS in Bioengineering (all but BMPH)

### Concentrations:

#### Computational Biomedical Engineering (CBM)

*BENG Concentration Courses:*  
 BENG 420 Biomedical Data Analytics (3)  
 BENG 430 Continuum Biomechanics and Transport II (3)  
 BENG 435 Multi-scale Modelling and Simulation in Biomedicine (3)

#### Biomedical Imaging and Devices (BMID)

*BENG Concentration Courses:*  
 BENG 420 Biomedical Data Analytics (3)  
*Pick 2 courses from the following:*  
 BENG 437 Medical Image Processing (3)  
 BENG 470 Bioinstrumentation and Devices II (3)  
 BENG 438 Advanced Biomedical Imaging (3)

#### Biomaterials and Nanomedicine (BNM)

*BENG Concentration Courses:*  
 BENG 413 Molecular Engineering Laboratory (3)  
 BENG 421 Cell and Tissue Engineering (3)  
 BENG 441 Nanomedicine and Drug Delivery (3)

#### Neurotechnology and Computational Neuroscience (NTCN)

*BENG Concentration Courses:*  
 BENG 327 Cellular, Neurophysiological, and Pharmacological Neuroscience (3)  
*Pick 2 courses from the following:*  
 BENG 429 Mason-Inova Applied Technologies (3)  
 BENG 434 Computational Modelling of Neurons and Networks (3)  
 BENG 487 Neuroinformatics (3)  
 BENG 426 Neural Engineering (3)

#### Bioengineering Health Care Informatics (BHI)

*BENG Concentration Courses:*  
 HAP 360 Introduction to Health Information Systems (3)  
 HAP 361 Health Databases OR IT 214 Database Fundamentals (3)  
 HAP 464 Electronic Health Record Configuration and Data Analysis (3)

#### Bioengineering Prehealth (BMPH)

See separate BMPH sample schedule

#### First Semester

MATH 113 Analytic Geom & Calc I 4  
 CHEM 271 Chemistry for Engineers 3  
 CHEM 272 Chemistry for Eng Lab 1  
 BENG 101 Intro to Bioengineering 3  
 Mason Core (ENGH 101)<sup>1</sup> 3

**Total Hours 14**

#### Second Semester

MATH 114 Analytic Geom. & Calc. II 4  
 PHYS 160 Univ Physics I 3  
 PHYS 161 Univ Physics I Lab 1  
 CS 112 Intro Comp Prog 4  
 CHEM 310 Survey of Organic Chemistry 3

**Total Hours 15**

#### Third Semester

MATH 213 Analytic Geom. & Calc. III 3  
 MATH 203 Linear Algebra<sup>2</sup> 3  
 PHYS 260 University Physics II 3  
 PHYS 261 University Physics II Lab 1  
 BIOL 213E Cell Structure and Function<sup>2</sup> 4

**Total Hours 14**

#### Fourth Semester

MATH 214 Elem. Differential Equations 3  
 BENG 230 Continuum Biomechanics and Transport I 3  
 BENG 240 Biomaterials 3  
 BENG 241 Biomechanics and Biomaterials Lab 1  
 BENG 214 Physiology for Engineers 3  
 Mason Core (Literature)<sup>1</sup> 3

**Total Hours 16**

#### Fifth Semester

BENG 414 Pathophysiology Human Dis 3  
 BENG 320 Bioengineering Signals & Sys 3  
 BENG 330 Comp Methods in BE 3  
 BENG 331 Comp Methods in BE Lab 1  
 STAT 350 Introductory Statistics II 3  
 ENGH 302 Advanced Composition (Nat Sci. and Multidisc.)<sup>1</sup> 3  
 BENG 391 BE Professional Development 1

**Total Hours 17**

#### Sixth Semester

BENG 360 Biomedical Imaging 3  
 BENG 370 Bioinstrumentation and Devices I 3  
 BENG 371 Bioinstrumentation and Devices Lab 1  
 BENG 350 Neural System Designs 3  
 BENG 475 IP, Reg, & Prod Dev (Glob. Und.)<sup>1</sup> 3

BENG Concentration #1 3

**Total Hours 16**

#### Seventh Semester

BENG 492 Senior Adv. Design Project I 3  
 BENG Concentration #2 3  
 Mason Core<sup>1</sup> 3  
 Technical Elective<sup>3</sup> 3  
 Mason Core<sup>1</sup> 3

**Total Hours 15**

#### Eighth Semester

BENG 493 Senior Adv. Design Project II 3  
 BENG Concentration #3 3  
 Technical Elective<sup>3</sup> 3  
 Mason Core<sup>1</sup> 3  
 ECON 103 or PSYC 100 or SOCI 101 3

**Total Hours 15**

<sup>1</sup><http://catalog.gmu.edu/mason-core> Mason Core Categories: One course from each: Oral Communication, ENGH101, Arts, Global Understanding (BENG 475), Literature, Western Civilization/World History, Social Behavioral Science (ECON 103 or PSYC 100 or SOCI 101). ENGH 101 and Mason Core-Literature must be completed before taking ENGH 302. <sup>2</sup>All bioengineers will be required to register for a specific section of MATH 203 including a 1-hour recitation with practical applications and for a specific section of BIOL 213. <sup>3</sup>Students choose from sets of approved technical electives.