

 FLORIDA ATLANTIC UNIVERSITY	NEW/CHANGE PROGRAM REQUEST Undergraduate Programs	UUPC Approval <u>10/10/22</u> UFS Approval _____ Banner _____ Catalog _____
	Department Dean's Office - assignment to department to come College College of Engineering and Computer Science	
Program Name B.S. Biomedical Engineering	<input checked="" type="checkbox"/> New Program* <input type="checkbox"/> Change Program*	Effective Date (TERM & YEAR) Spring 2023
Please explain the requested change(s) and offer rationale below or on an attachment. <p>The objective of the degree program is to produce undergraduates in engineering, medicine or the sciences and/or professional practice as a biomedical engineer, medical systems researcher, medical professional in government or industry.</p> <p>The proposed new B.S. in Biomedical Engineering degree program has five areas of focus: 1 - Biomaterials and Tissue Engineering, 2 - Smart Health Systems, 3 - Bio-Robotics, 4 - Bioimaging/ Nursing Technologist and 5 - Bioinformatics. The proposed Biomedical Engineering degree program is the first to offer the Nursing Technologist track and an interface with FAU's artificial intelligence center that will add benefits to the Bio-Robotics and Smart Health system focus areas.</p> <p>(The degree program is intended to meet all requirements for receiving ABET accreditation and be completed with 120 credits. Most of the required classes currently exist and are being offered by the university in other degree programs. All five tracks are easily achievable in 4 years and as a result, the 4-yr graduation rates are expected to be high.</p> <p>The purpose of the degree program is to supply a host of businesses and organizations with undergraduates with the skill set to help them accomplish their mission. Many of these opportunities will be in medical research and healthcare. For example, this degree program will exist at the cross-section the FAU Brain Institute (I-Brain) and the FAU Biomedical Research Institute (I-Heal) and will encompass tools developed by FAU's Sensing and Smart Systems pillar and the artificial intelligence center in the College of Engineering and Computer Science. There are opportunities with the Max Planck Institute on the Jupiter campus for research in the medical industry.</p>		
<small>*All new programs and changes to existing programs must be accompanied by a catalog entry showing the new or proposed changes.</small>		
Faculty Contact/Email/Phone Frederick Bloetscher, Ph.D., P.E., Professor Associate Dean for Undergraduate Studies and Community Outreach	Consult and list departments that may be affected by the change(s) and attach documentation Chemistry, Physic, Biology, Electrical Engineering and Computer Science, Ocean and Mechanical Engineering	
Approved by Department Chair _____ College Curriculum Chair _____ Hongbo Su College Dean _____ UUPC Chair _____ <i>Ethlyn Williams</i> Undergraduate Studies Dean _____ <i>Dan Meeroff</i> UFS President _____ Provost _____		Date <u>10/2/22</u> <u>10/2/22</u> <u>10/10/22</u> <u>10/10/22</u> _____ _____

Email this form and attachments to mjenning@fau.edu seven business days before the UUPC meeting.

Biomedical Engineering

Faculty: .Agaarwal, A.; Asghar, W.; Assis, R.; DeGiorgio, M.; Du, S.; Engeberg, E.; Ghoraani, B.; Hashemi, J.; Kang, Y.; Pavlovic, M.; Ranji, M.; Pashaie, R.; Shankar, R.; Zhi, H,

Affiliated Faculty:

Adjunct Faculty:

[Link to Bachelor of Science in Biomedical Engineering \(B.S.B.M.E.\)](#)

[Link to Combined B.S.B.M.E. to M.S. degree program](#)

Biomedical Engineering

BACHELOR'S PROGRAM

The program of study leading to the Bachelor of Science in Biomedical Engineering (B.S.B.M.E.) reflects the breadth of the profession. Students complete coursework in basic science and mathematics, engineering sciences, and engineering systems and materials. The major includes five areas of focus: 1- Biomaterials and Tissue Engineering, 2- Smart Health Systems, 3- Bio-robotics, 4- Bio-informatics and 5- Bioimaging. The proposed Biomedical Engineering program, is the first to offer the Bioimaging track and an interface with our artificial intelligence center that will add benefits to the Bio-Robotics and Smart Health Systems focus areas.

Biomedical Engineering Educational Objectives and Student Outcomes

The Biomedical Engineering program strongly supports the educational objectives and learning outcomes of the College of Engineering and Computer Science (see the [Educational Objectives](#) and [Expected Student Learning Outcomes](#) subsections previously listed in this section).

Program Educational Objectives are broad statements that describe the expected accomplishments and professional status of Biomedical Engineering graduates a few years beyond the baccalaureate degree.

The Biomedical Engineering program at Florida Atlantic University is dedicated to graduating engineers who, within a few years after graduation will:

A. **Practice biomedical engineering** within the general areas of biomaterials and tissue engineering, bio-robotics, bioinformatics, bioimaging technology and smart health systems in the organizations that employ them;

B. **Advance their knowledge of biomedical engineering**, both formally and informally, by engaging in lifelong learning experiences including attainment of professional licensure and/or graduate studies;

C. **Serve as effective professionals** based on strong interpersonal and teamwork skills, an understanding of professional and ethical responsibility and a willingness to take the initiative and seek progressive responsibilities;

D. **Participate as leaders** in activities that support service to, and/or economic development of, the community, the region, the state and the nation.

The educational objectives of the Bachelor of Science in Biomedical Engineering program are achieved by ensuring that graduates have the following characteristics or student outcomes:

1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics;
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors;
3. An ability to communicate effectively with a range of audiences;

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts;

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives;

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions;

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.



Bachelor of Science in Biomedical Engineering

(Requires 120 credits.)

Admission Requirements

All students must meet the minimum admission requirements of the University. Please refer to the [Admissions section](#) of this catalog.

All students must meet the preprofessional requirements listed [above](#) to be accepted in the B.S.B.M.E. program.

Prerequisite Coursework for Transfer Students

Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the [Transition Guides](#) and below.

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

Degree Requirements

The Bachelor of Science in Biomedical Engineering degree will be awarded to students who:

1. Meet all general degree requirements of the University;
2. Complete the curriculum for the B.S. in Biomedical Engineering degree (see below);

Curriculum

The Bachelor of Science in Biomedical Engineering degree requires 120 credits. For credit toward the degree, a grade of "C" or better must be received in each course listed. In addition, all prerequisites for each mathematics, science or engineering course must be completed with a grade of "C" or better before enrollment is permitted. The degree components are listed below.

Intellectual Foundations Program		
College Writing 1	ENC 1101	3
College Writing 2	ENC 1102	3
Intellectual Foundations Program : Society and Human Behavior Courses		6
Intellectual Foundations Program : Global Citizenship Courses		6

Intellectual Foundations		6
Program: Humanities Courses		

Foundations of Math and Quantitative Reasoning		
Calculus with Analytic Geometry 1 (1,4)	MAC 2311	4
Calculus with Analytic Geometry 2 (1,4)	MAC 2312	4
Foundations of Science and the Natural World		
General Chemistry 1 (1,5)	CHM 2045	3 and
General Chemistry Lab 1	CHM 2045L	1
General Physics for Engineers 1 (1,5,7)	PHY 2048	3 and
General Physics 1 Lab	PHY 2048L	1
Total		40

Basic Mathematics and Sciences		
Statistics Restricted Elective		3
Engineering Mathematics 1	MAP 3305	3 or
Differential Equations 1	MAP 2302	3
Biological Principles (5)	BSC 1011	3 and
Biological Principles Lab	BSC 1011L	1
General Chemistry 2 (5)	CHM 2046	3 and
General Chemistry 2 Lab	CHM 2046L	1
General Physics for Engineers 2 (5)	PHY 2049	3 and
General Physics 2 Lab	PHY 2049L	1
Organic Chemistry	CHM 2210	3
Organic Chemistry 2	CHM 2211	3
Organic Chemistry 2 Lab	CHM 2211L	1
Biochemistry	BCH 3033	3 and
Biochemistry Lab	BCH 3033L	1
Anatomy & Physiology 1	BSC2085	3 and
Anatomy & Physiology 1 Lab	BSC2085L	1
Genetics	PCB 3063	4
Total		33

Statistics Restricted Elective: Probability and Statistics for Engineers (STA 4032), Stochastic Models for Computer Science (STA 4821), Probability and Statistics 1 (STA 4442), Biostatistics (STA 3173) or equivalent.

(total above is 73 – leaving 47 credits of engineering classes to comply with ABET criteria)

Students are encouraged to take a course in ethics of technology

Engineering Fundamentals		
Intro or Fundamentals of Engineering	EGN 1002	3
<i>Engineering Graphics Elective</i>		
Computer Aided Design	CGN 2327	3 or

Engineering Graphics	EGN 1111C	3
Intro to Programming in Python	COP 3035	3
Statics	EGN 3311	3
Dynamics	EGN 3321	3
Data Structures and Algorithms with Python (COP 3043) for Bioinformatics track and Smart Health track, or Thermodynamics (EGN 3343) for Biomaterials and Tissue Engineering track and Biorobots track	COP 3043 or EGN 3331	3
Circuits 1	EEL 3111	3
Signal and Digital Filter Design	EEL 3514	3
Introduction to Biomedical Engineering	BME 4001	3
Total		27

Capstone Design Core		
RI: Engineering Design 1 (5)	EGN 4950C	3
RI: Engineering Design 2 (5)	EGN 4952C	3
Total		6

Choose 2 focus areas (for a total of 12 credits, 6 from both areas chosen)

Biomaterials and Tissue Engineering Focus Area (choose 3 from the list)		
Tissue Engineering	BME 4331	3
Stem Cell Engineering	BME 6324	3
Nanotechnology or Intro to Nanobiotechnology	BME 4571 or BME 4574	3
Neural Engineering	BME 4361	3
Total		6

Bio robotics Focus Area (choose 2 from the list)		
Intro to Robotics	EML 4800	3
Electro-Mechanical Devices	EGM 4045	3
Introduction to Microfluidics and BioMEMS	BME 4581	3
Total		6

Bioimaging Technologist Focus Area		
Intro to Bioimaging	BME 4512	3
Introduction to Bio signal Processing	BME 4523	3
Total		6

Bioinformatics Focus Area		
Computational Genomics	CAP 4514	3

Algorithms for Bioinformatics	CAP 4543	3
Total		6

Smart Health Systems Focus Area (choose 2 from the list)		
Biosystems Modeling and Control	BME 4741	3
Intro to Artificial Intelligence	CAP 4630	3
Data Mining & Machine Intelligence	CAP 4770	3
Intro to Deep Learning	CAP 4613	
Total		6

Technical Electives (Select 2 credits from the list)		
Engineering Professional Internship	EGN 3941 or IDS3949	0-2
For pre-med students – choose biology lab (1 cr) and one other science lab (1))		0-2
Directed Independent Research in Engineering and Computer Science or College of Science (6)	EGN 4915	0-2
Total		2

Notes:

(1) Contributes to University Core Curriculum requirements.

(2) Contributes to Writing Across Curriculum (Gordon Rule) writing requirement.

(3) Intellectual Foundations Program courses, totaling 6 credits, must be selected to satisfy Writing Across Curriculum (Gordon Rule) writing requirements.

(4) Contributes to Gordon Rule mathematics requirement.

(5) Includes a 1-credit laboratory.

(6) Grading: S/U.

(7) PHY 2048, General Physics 1 (4 credits) is an acceptable substitute, but only 3 credits will apply toward the degree.

Sample Four-Year Program of Study
For the sample four-year program of study for the Bachelor of Science in Biomedical Engineering, refer to the [Curriculum Sheets and Flight Plans](#) by major.

Fall	Cr	Spring	Cr
Calc 1 MAC 2311	4	Calc 2 MAC 2312	4
Chemistry 1 CHM2045	3	English Comp 2 ENG 1102	3
Chem Lab 1 CHM2045L	1	Physics for Eng. 1 PHY2048	3
English Comp 1 ENG 1101	3	Physics for Eng. 1 lab PHY2048L	1
Biology 1 BSC 1010	3	Chemistry 2 CHM2046	3

Biology 1 Lan BSC 1010L	1
	15

Chem Lab 2 CHM2046L	1
	15

Emath MAP 3305	3
Fund of Eng. (EGN1002)	3
Physics for Eng. 2 PHY2049	3
Statics EGN3311	3
Physics for Eng. 2 lab PHY2049L	1
Organic Chem 1 CHM 2210	3
	16

Organic Chem 2 CHM 2211	3
Organic Chem 2 CHM 2211L	1
Biochemistry BCH 3033	3
Biochemistry lab BCH 3033L	1
Statistics Elective	3
Circuits EEL 3111	3
	14

Thermo or COP 3043	3
IFP	3
Intro to Bio Med BME4001	3
Anatomy & Phys BSC 2085	3
Anatomy & Phys Lab BSC2085L	1
Dynamics (EGN3321)	3
	16

Signals & Digital Filters EEL 3514	3
IFP	3
Nano or Neural BME 4571/4	3
IFP	3
Drafting class elective	3
Intro to Python (COP2034)	3
	18

IFP	3
Sr Design	3
Tech Elective 1	3
Tech Elective 2	3
Internship/DIR/Lab	1
	13

IFP	3
Sr Design	3
Tech Elective 3	3
Tech Elective 4	3
Internship/DIR/Lab	1
	13

120

Internships

Biomedical Engineering students are strongly encouraged to gain practical experience through participation in internship opportunities. However, internships require with prior approval from the department and coordinated with the Career Center (EGN 3941, Engineering Professional Internship). For more information, contact the FAU Career Center at 561-297-3533 or visit www.fau.edu/cdc.