2023 - 2024 Major Map
Biomedical Engineering, BSE

School/College: Ira A. Fulton Schools of Engineering
ESBMEBSE

Term 1 0 - 16 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
ASU 101-BME: The ASU Experience	1	C	• ASU 101 or college-specific equivalent First-Year Seminar required of all first-year students. • If ENG 105 is taken, a three 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	
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	
FSE 100: Introduction to Engineering	2	C	
STP 226: Elements of Statistics (CS) OR STP 231: Statistics for Life Science (CS)	3	C	
Minimum 2.00 GPA ASU Cumulative.			
Term hours subtotal:	16		

Term 2 16 - 30 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
BIO 181: General Biology I (SQ)	4	C	• 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	
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 ENG 101 OR ENG 105 OR ENG 107 course(s).			
Complete FSE 100 course(s).			
Minimum 2.00 GPA ASU Cumulative.			
Term hours subtotal:	14		

Term 3 30 - 46 Credit Hours Critical course signified by	Hours	Minimum Grade	Notes
MAT 242: Elementary Linear Algebra	2	C	• Select your Bioscience Elective course(s) from the approved list found at the bottom of the major map.
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
	Bioscience Elective	4	C
❗	Minimum 2.00 GPA ASU Cumulative.		
	Complete Mathematics (MA) requirement.		
	Term hours subtotal:	16	

- Prep for success using the Sophomore Guide.

Term 4 46 - 60 Credit Hours Critical course signified by ❗	**Hours**	**Minimum Grade**	**Notes**
❗ BME 200: Conservation Principles in Biomedical Engineering	3	C	• 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	
EEE 202: Circuits I	4	C	
Term hours subtotal:	14		

Term 5 60 - 76 Credit Hours Necessary course signified by ★	**Hours**	**Minimum Grade**	**Notes**
★ BME 350: Signals and Systems for Bioengineers OR BIO 353: Cell Biology	3	C	• Select your Upper Division Engineering Elective courses from the approved list found at the bottom of the major map. • The general studies requirements for HU, SB, and the awareness areas (C, G, H) do not have to be taken in exact combinations as outlined on the major map. By the end of term 8, all must be completed; however, the combinations may vary. • 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	
Upper Division Engineering Elective	3	C	
Humanities, Arts and Design (HU) AND Cultural Diversity in the U.S. (C)	3		
Term hours subtotal:	16		

Term 6 76 - 91 Credit Hours Necessary course signified by ★	**Hours**	**Minimum Grade**	**Notes**
★ BME 370: Microcomputer Applications in Biomedical Engineering OR BME 360: Control in Biological Systems AND BME 362: Methods in Molecular and Cellular Biology	3-4	C	• Select your Upper Division Engineering Elective courses from the approved list found at the bottom of the major map. • Research and prepare for graduate school. • Apply for an engineering 4+1 program. • Develop a professional profile online.
BME 213: Biomedical and Bioengineering Ethics	1	C	
BME 300: Bioengineering Product Design	3	C	
BME 301: Numerical Methods in Biomedical Engineering	2	C	

	BME 316: Biomechanics for Biomedical Engineers	3	C
	Upper Division Engineering Elective	3	C
★	Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).		
	Term hours subtotal:	15-16	

Term 7 91 - 105 Credit Hours Necessary course signified by ★	**Hours**	**Minimum Grade**	**Notes**
★ BME 413: Biomedical Instrumentation (L) AND BME 423: Biomedical Instrumentation Laboratory (L) OR BME 467: Tissue Engineering and Regenerative Medicine	4-3	C	• Select your Upper Division Related Elective courses from the approved list found at the bottom of the major map. • The general studies requirements for HU, SB, and the awareness areas (C, G, H) do not have to be taken in exact combinations as outlined on the major map. By the end of term 8, all must 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.
★ BME 417: Biomedical Engineering Capstone Design I (L)	4	C	
Upper Division Related Elective	3	C	
Social-Behavioral Sciences (SB) AND Global Awareness (G)	3		
Term hours subtotal:	14-13		

Term 8 105 - 120 Credit Hours Necessary course signified by ★	**Hours**	**Minimum Grade**	**Notes**
★ BME 490: Biomedical Engineering Capstone Design II (L)	4	C	• Select your Upper Division Related Elective courses from the approved list found at the bottom of the major map. • The general studies requirements for HU, SB, and the awareness areas (C, G, H) do not have to be taken in exact combinations as outlined on the major map. By the end of term 8, all must be completed; however, the combinations may vary.
Upper Division Related Elective	2	C	
Upper Division Humanities, Arts and Design (HU) OR Upper Division Social-Behavioral Sciences (SB)	3		
Humanities, Arts and Design (HU) AND Historical Awareness (H)	3		
Social-Behavioral Sciences (SB)	3		
Term hours subtotal:	15		

- ○ Students must complete at least 10 credit hours from the Upper Division Biomedical Engineering Core list.

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

Bioscience Electives	Upper Division Engineering Electives	Upper Division Related Electives
BIO 182: General Biology II (SG)	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)	ACC 382: Accounting and Financial Analysis
BIO 201: Human Anatomy and Physiology I (SG)		BCH 361: Advanced Principles of Biochemistry
CHM 231: Elementary Organic Chemistry (SQ) AND CHM 235:		BCH 367: Elementary Biochemistry

Elementary Organic Chemistry Laboratory (SQ)

CHM 233: General Organic Chemistry I AND CHM 237: General Organic Chemistry Laboratory I

MIC 205: Microbiology (SG) AND MIC 206: Microbiology Laboratory (SG)

BME 340: Thermodynamics for Biomedical Engineers or CHE 342: Introduction to Applied Chemical Thermodynamics

BME 465: Magnetic Resonance Imaging

BME 494: Bioenergy and Microbial Biotechnology

BME 494: Finite Element Modeling for Biomedical Application

BME 494: Medical Imaging Instrumentation

BME 494: Polymeric Drug Delivery

BME 494: Systems Biology of Disease

BME 494: Technology for Global Health

BMI 311: Modeling Biomedical Knowledge

CEE 384: Numerical Methods for Engineers (CS)

CHE 468: Polymer Principles and Processing

CHE 473: Fuel Cells and Biofuel Cells

CHE 478: Biomass Energy Conversion Technology

CHE 479: Microbial Bioprocess Engineering

CHE 494: Fundamentals of Scaleup

CHE 494: Nanobiotechnology

CHE 494: Soft Matter Morphology

CHE 494: Sustainable Macromolecular Synthesis

CHM 325: Analytical Chemistry

CHM 341: Elementary Physical Chemistry or BCH 341: Physical Chemistry with a Biological Focus

CSE 340: Principles of Programming Languages

DAT 301: Exploring Data in R and Python

EEE 334: Circuits II

EEE 350: Random Signal Analysis

EEE 352: Properties of Electronic Materials

EEE 407: Digital Signal Processing

EEE 481: Computer-Controlled Systems

HCD 403: Process Engineering

IEE 300: Economic Analysis for Engineers

IEE 380: Probability and Statistics for Engineering Problem Solving (CS)

IEE 381: Lean Six Sigma Methodology

Laboratory

BCH 461: General Biochemistry

BCH 462: General Biochemistry

BCH 467: Analytical Biochemistry Laboratory (L)

BIO 302: Cancer--Mother of All Diseases (L)

BIO 312: Bioethics (HU) or PHI 320: Bioethics (HU)

BIO 331: Animal Behavior

BIO 340: General Genetics or MBB 347: Molecular Genetics: From Genes to Proteins

BIO 345: Evolution

BIO 360: Animal Physiology

BIO 440: Functional Genomics or MBB 440: Functional Genomics

BIO 451: Cell Biotechnology: Cell Culture, Immunocytochemistry and Bioimaging

BIO 467: Neurobiology

BME 394: Honors Research

BME 394: SBHSE Research Projects

BME 492: Honors Directed Study

BME 493: Honors Thesis (L)

BMI 465: Introduction to Comparative Genomics

BUA 380: Small Business Leadership

BUA 381: Small Business Accounting and Finance

BUA 383: Small Business Working Relationships

BUS 384: Business Operations and Planning

CHE 475: Biochemical Engineering

CHM 302: Environmental Chemistry

CHM 326: Advanced Analytical Chemistry Laboratory

CIS 300: Web Design and Development

COM 312: Communication, Conflict, and Negotiation

CSE 310: Data Structures and Algorithms

CSE 412: Database Management

ECN 306: Survey of International Economics (SB & G)

MAE 384: Advanced Mathematical Methods for Engineers (CS)

MAT 451: Mathematical Modeling (CS)

MEE 322: Structural Mechanics

MEE 340: Heat Transfer

MSE 415: Mathematical and Computer Methods in Materials (CS)

MSE 440: Mechanical Behavior of Materials

MSE 450: Introduction to Materials Characterization

MSE 451: Nanomaterials and Electronics Characterization Lab

MSE 470: Polymers and Composites

MSE 471: Introduction to Ceramics

MSE 482: Materials Engineering Design (L)

TWC 446: Technical and Scientific Reports (L)

TWC 451: Copyright and Intellectual Property in the Electronic Age

Upper Division Related Electives continued

EDP 310: Developing as a Leader (SB)

EDP 310: Emotional Intelligence (SB)

EDP 310: Gender Development (SB)

EDP 310: Learning and Memory (SB)

EDP 310: Motivation (SB)

EDP 310: Understanding the Brain (SB)

EEE 307: Signal Processing for Digital Culture

EEE 407: Digital Signal Processing

EEE 480: Feedback Systems

ENT 305: Principles of Entrepreneurship

FIN 300: Fundamentals of Finance

FIN 380: Personal Financial Management

FSE 301: Entrepreneurship and Value Creation or ENT 360: Entrepreneurship and Value Creation

HCR 350: Introduction to Clinical Research

IEE 320: Extreme Excel

IEE 369: Work Analysis and Design (L)

IEE 431: Engineering Administration (L)

IND 464: Collaborative Design Development I (L)

Upper Division Related Electives, continued

MGT 300: Principles of Management and Leadership

MGT 302: Principles of International Business (G)

MGT 380: Management and Strategy for Nonmajors

MIC 314: HIV/AIDS: Science, Behavior, and Society

MIC 360: Bacterial Physiology

MIC 420: Immunology: Molecular and Cellular Foundations or BIO 420: Immunology: Molecular and Cellular Foundations

MKT 300: Marketing and Business Performance

MKT 370: Professional Sales and Relationship Management

MKT 390: Essentials of Marketing

MKT 391: Essentials of Selling

MSE 330: Thermodynamics of Materials

MSE 335: Materials Kinetics

MSE 355: Structure and Defects

MSE 356: Thin Film and Microelectronic Devices Lab

MSE 420: Advanced Metallurgical Alloys and Processes

- IND 465: Collaborative Design Development II (L)
- KIN 334: Functional Anatomy and Kinesiology
- KIN 340: Physiology of Exercise
- KIN 412: Biomechanics of the Skeletal System
- KIN 413: Qualitative Analysis in Sport Biomechanics
- KIN 414: Electromyographic Kinesiology (L)
- KIN 440: Exercise Biochemistry
- LES 305: Business Law and Ethics for Managers
- LES 380: Consumer Perspective of Business Law
- LSC 347: Fundamentals of Genetics
- MAE 318: System Dynamics and Control I
- MAE 341: Mechanism Analysis and Design
- MAE 417: System Dynamics and Control II
- MAT 300: Mathematical Structures (L)
- MAT 310: Introduction to Geometry
- MAT 342: Linear Algebra or MAT 343: Applied Linear Algebra
- MAT 460: Vector Calculus
- MAT 462: Applied Partial Differential Equations
- MBB 343: Genetic Engineering and Society (L) or BIO 343: Genetic Engineering and Society (L)
- MSE 421: Physical Metallurgy Laboratory
- MSE 442: Fatigue, Fracture, and Creep of Materials
- MSE 458: Electronic, Magnetic, and Optical Properties
- MSE 460: Nanomaterials in Energy Production and Storage
- NTR 457: Sports Nutrition
- PAF 301: Applied Statistics (CS)
- PAF 410: Building Leadership Skills (SB)
- PHI 306: Applied Ethics (HU)
- PHI 313: Probability, Evidence, and Decision
- PHY 361: Introductory Modern Physics
- PSY 325: Physiological Psychology
- PSY 470: Psychopharmacology
- SCM 300: Global Supply Operations
- SOC 334: Technology and Society (L or SB)
- STP 420: Introductory Applied Statistics (CS)
- STP 421: Probability
- 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 next to courses on the major map were valid for the 2023 - 2024 academic year. Please refer to the course catalog for current General Studies designations at time of class registration. General Studies credit is applied according to the designation the course carries at the time the class is taken.