

BIOMEDICAL ENGINEERING (BS)

Program Requirements

Course	Title	Hours
First Year		
Fall		
CHEM 101	General Chemistry I	3
CHEM 101L	General Chemistry I Lab	1
DEPT 193	FYS:	3
MATH 157	Calculus and Analytic Geometry I	4
COMM 100	Communication and Speech	3
PHIL 101	Reasoning	3
Hours		17
Spring		
ENGL 101	Writing	3
MATH 258	Calculus and Analytic Geometry II	4
BIOL 105	Information Flow in Biological Systems	3
BIOL 105L	Information Flow in Biological Systems Lab	1
MENG 291	Introduction to Mechanical Engineering Design	2
MENG 291L	Introduction to Mechanical Engineering Design Lab	1
PHIL 201	Philosophy of Human Nature	3
Hours		17
Second Year		
Fall		
MATH 259	Calculus and Analytic Geometry III	4
PHYS 121	Physics I	4
PHYS 121L	Physics I Lab	1
ENSC 205	Statics	3
Approved Computing Course		3
CPSC 121	Computer Science I	
CPSC 215	Special Topics	
ENSC 201	Programming for Engineers	
or as approved by Biomedical Engineering Department Chair		
BIOL 106	Energy Flow in Biological Systems	3
Hours		18
Spring		
MATH 260	Ordinary Differential Equation	3
MATH 321	Statistics for Experimentalist	3
ENSC 306	Dynamics	3
ENSC 301	Mechanics of Materials I	3
Ethics Core Elective		3
RELI XXX World or Comparative Religion		3
Hours		18
Third Year		
Fall		
CHEM 230 & 230L	Organic Chemistry I and Organic Chemistry Lab I	4
EENG 201 & 201L	Circuit Analysis I and Circuit Analysis I Lab	4
HPHY 241 & 241L	Human Anatomy and Physiology and Human Anatomy and Physiology Lab	4
1st Core Broadening Requirement: (History, Literature, Social and Behavioral Science)		3
Hours		15
Spring		
PHYS 122 & 122L	Physics II and Physics II Lab	5
Select one of the following:		
BENG 320	Bio Thermo/Fluids	

ENSC 355	Thermal Science	
Technical Elective		3
2nd Core Broadening Requirement: (History, Literature, Social and Behavioral Science)		3
RELI XXX Christianity and Catholic Traditions		3
Hours		14
Fourth Year		
Fall		
BENG 410	Biotransport	3
Select one of the following:		3-4
BENG 301	Biomedical Signals and Systems	
EENG 311	Signals and Systems I	
Select one of the following:		3
EENG 411	Introduction to Control Systems	
MENG 461	System Dynamics and Control	
ENSC 491	Senior Design Project I	2
Technical Elective		3
Technical Elective		3
Hours		17-18
Spring		
ENSC 400	Foundations of Engineering Exam	0
ENSC 492	Senior Design Project II	3
BENG 421 & 421L	Modeling of Biomedical Systems and Modeling of Biomedical Systems Lab	4
BENG 415	FDA Regulations and Ethics	2
Technical Elective		3
BENG 432	CIS: (CIS:)	3
Hours		15
Total Hours		131-132

Technical Electives

The courses used to satisfy the technical elective requirements must normally be selected from the following list. However, students may take other courses for technical elective credits but only with the prior approval of both the student's academic advisor and the Director of the Biomedical Engineering program. The actual technical elective courses offered from the list below varies from year to year and the program may on occasion offer one or more pre-approved technical elective courses that are not listed below. By following the above curriculum, students are not guaranteed to have all the necessary prerequisites for every course on this list. Students wishing to take these courses should plan well in advance in order to comply with all admission requirements prior to enrolling in the course. All students must complete at least 12 credits of technical electives. At least 3 credits must be from engineering courses (i.e. BENG, CPEN, EENG, MENG, or ENSC).

Code	Title	Hours
BIOL 207	Genetics	3
BIOL 207L	Genetics Lab	1
BIOL 351	Advanced Cell Biology	3
BIOL 351L	Advanced Cell Biology Lab	1
BIOL 370	Microbiology	3
BIOL 370L	Microbiology Lab	1
BIOL 456	Molecular Biology	3
BIOL 456L	Molecular Biology Lab	1
CHEM 231	Organic Chemistry II	3
CHEM 231L	Organic Chemistry Lab II	1
CHEM 307	Biochemistry I	3
CHEM 307L	Biochemistry I Lab	1

CHEM 308	Biochemistry II	3
CHEM 405-CHEM 480	Special Topics Electives	3
HPHY 242	Human Anatomy and Physiology II	3
HPHY 242L	Human Anatomy and Physiology Lab II	1
HPHY 274	Musculoskeletal Dynamics and Physiology	3
HPHY 375	Biomechanics	3
HPHY 375L	Biomechanics Lab	1
CPSC 222	Introduction to Data Science	3
CPEN 231	Embedded Computer Systems	3
CPEN 436	Machine Learning in Biomed	3
EENG 322	Signals and Systems II	3
EENG 401	Lower Power Bioelectronics	3
EENG 424	Digital Signal Processing	3
MENG 221	Materials Engineering	3
MENG 330	Machine Design	3
MENG 468	Biomaterials and Biomechanical Engineering	3
MENG 456	Design for Manufacturing	3
MENG 465	Introduction to Finite Element	3
MENG 477	Materials Selection for Design	3
MENG 479	Tribology	3
ENSC 481	Special Topics in Engineering	1-6
PHYS 452	Optics	3
PHYS 456	Biophysical Systems and Modeling	3

¹ Approved courses are: CPSC 121 Computer Science I, ENSC 201 Programming for Engineers, CPSC 215 Special Topics, or as approved by the Biomedical Engineering Program Director

University Core

In addition to their major and minor areas of study, all undergraduate students follow a common program designed to complete their education in those areas that the University considers essential for a Catholic, Jesuit, liberal, and humanistic education. The University Core Curriculum consists of forty-five credits of course work, with additional designation requirements that can be met through core, major, or elective courses.

The University Core Curriculum is a four-year program, organized around one overarching question, which is progressively addressed through yearly themes and questions. Hence, core courses are best taken within the year for which they are designated. First year core courses encourage intellectual engagement and provide a broad foundation of fundamental skills. Second and third year courses examine central issues and questions in philosophy and religious studies. The fourth year course, the Core Integration Seminar, offers a culminating core experience. Taken at any time throughout the four years, broadening courses intersect with the core themes and extend students' appreciation for the humanities, arts, and social and behavioral sciences. Finally, the designation requirements (writing enriched, global studies, and social justice) reflect important values and reinforce students' knowledge and competencies.

Overarching Core Question: As students of a Catholic, Jesuit, and Humanistic University, how do we educate ourselves to become women and men for a more just and humane global community?

Year 1 Theme and Question: Understanding and Creating: How do we pursue knowledge and cultivate understanding?

- The First-Year Seminar (DEPT 193, 3 credits): The First-Year Seminar (FYS), taken in the fall or spring of the first year, is designed to promote an intellectual shift in students as they transition to college academic life. Each small seminar is organized around an engaging topic, which students explore from multiple perspectives. The FYS is offered by many departments across the University (click here [PDF] (<https://www.gonzaga.edu/catalogs/current/undergraduate/school-of-engineering-and-applied-science/course-detail/?code=PHIL+101>) for list of FYS courses).
- Writing (ENGL 101 Writing, 3 credits) and Reasoning (PHIL 101 Reasoning, 3 credits): The Writing and Reasoning courses are designed to help students develop the foundational skills of critical reading, thinking, analysis, and writing. They may be taken as linked sections. Writing (ENGL 101 Writing) carries one of the three required writing-enriched designations (see below).
- Communication & Speech (COMM 100 Communication and Speech, 3 credits): This course introduces students to interpersonal and small group communication and requires the application of critical thinking, reasoning, and research skills necessary to organize, write, and present several speeches.
- Scientific Inquiry (BIOL 104 Scientific Inquiry/BIOL 104L Scientific Inquiry Lab, CHEM 104 Scientific Inquiry/CHEM 104L Scientific Inquiry Lab, or PHYS 104 Scientific Inquiry/, 3 credits): This course explores the scientific process in the natural world through evidence-based logic and includes significant laboratory experience. Students pursuing majors that require science courses will satisfy this requirement through their major.
- Mathematics (above Math 100, 3 credits): Mathematics courses promote thinking according to the modes of the discipline—abstractly, symbolically, logically, and computationally. One course in mathematics, above Math 100, excluding MATH 193 FYS: and including any math course required for a major or minor, will fulfill this requirement. MATH 100 College Algebra (College Algebra) and courses without the MATH prefix do not fulfill this requirement.

Year 2 Theme and Question: Being and Becoming: Who are we and what does it mean to be human?

- Philosophy of Human Nature (PHIL 201 Philosophy of Human Nature, 3 credits): This course provides students with a philosophical study of key figures, theories, and intellectual traditions that contribute to understanding the human condition; the meaning and dignity of human life; and the human relationship to ultimate reality.
- Christianity and Catholic Traditions (RELI, 3 credits). Religious Studies core courses approved for this requirement explore diverse topics including Christian scriptures, history, theology, and practices as well as major contributions from the Catholic intellectual and theological traditions (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9> a list of approved courses).

Year 3 Theme and Question: Caring and Doing: What principles characterize a well lived life?

- Ethics (PHIL 301 Ethics or RELI, 3 credits): The Ethics courses are designed to help students develop their moral imagination by exploring and explaining the reasons humans should care about the needs and interests of others. This requirement is satisfied by an approved ethics course in either Philosophy (PHIL 301 Ethics) or Religious Studies (click here [PDF] (<https://>

gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?

rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).

- World/Comparative Religion (RELI, 3 credits): Religious Studies courses approved for this core requirement draw attention to the diversity that exists within and among traditions and encourage students to bring critical, analytical thinking to bear on the traditions and questions considered. These courses carries one of the required two global-studies designations (see below) (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).

Year 4 Theme and Question: Imagining the Possible: What is our role in the world?"

- Core Integration Seminar (DEPT 432, 3 credits). The Core Integration Seminar (CIS) offers students a culminating core experience in which they integrate the principles of Jesuit education, prior components of the core, and their disciplinary expertise. Some CIS courses may also count toward a student's major or minor. The CIS is offered by several departments across the University (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for list of CIS courses).

The Broadening Courses

- Fine Arts & Design (VART, MUSC, THEA, 3 credits): Arts courses explore multiple ways the human experience can be expressed through creativity, including across different cultures and societies. One approved course in fine arts, music, theatre, or dance will fulfill this requirement (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).
- History (HIST, 3 credits): History courses are intended to develop students' awareness of the historical context of both the individual and the collective human experience. One course in History (HIST 101 Foundations of the West, HIST 102 The West and the World, HIST 112 World History, HIST 103 United States History I, HIST 104 United States History II) will fulfill this requirement.
- Literature (3 credits): Literature courses foster reflection on how literature engages with a range of human experience. One approved course in Literature (offered by English, Classics, or Modern Languages) will fulfill this requirement (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).
- Social & Behavioral Sciences (3 credits): Courses in the social and behavioral sciences engage students in studying human behavior, social systems, and social issues. One approved course offered by Criminal Justice, Economics, Political Science, Psychology, Sociology, or Women and Gender Studies will fulfill this requirement (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).

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The Designations

Designations are embedded within already existing core, major, minor, and elective courses. Students are encouraged to meet designation requirements within elective courses as their schedule allows; however, with careful planning students should be able to complete most of the designation requirements within other core, major, or minor courses.

- Writing Enriched (WE; 3 courses meeting this designation): Courses carrying the WE designation are designed to promote the desired pedagogical ideal of clear, effective communication. In addition to the required core course, Writing (ENGL 101 Writing), which carries one of the WE designations, students must take two other WE-designated courses (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).
- Global-Studies (GS; 2 courses meeting this designation): Courses carrying the GS designation are designed to challenge students to perceive and understand human diversity by exploring diversity within a context of constantly changing global systems. In addition to the required core course, World/Comparative Religion (RELI 309-Excel) which carries one of the GS designations, students must take one other GS-designated course (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).
- Social-Justice (SJ; 1 course meeting this designation): Courses carrying the SJ designation are designed to introduce students to one or more social justice concerns. Students must take one course that meets the SJ designation (click here [PDF] (<https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74>) for a list of approved courses).

Major-specific adaptations to the University Core Curriculum

All Gonzaga students, regardless of their major, will complete the University Core Curriculum requirements. However some Gonzaga students will satisfy certain core requirements through major-specific programs or courses. Any major-specific adaptations to the core are described with the requirements for the majors to which they apply.

Honors Program Requirements

Students must take the following courses to complete their Honors degree

Code	Title	Hours
HONS 100	Multi-modal Communications	3
PHIL 101	Reasoning	3
HONS 193	FYS:	3
HONS 432	CIS	3
HONS 499	Honors Senior Project	3
Select five of the following: ¹		15-16

HONS 104 & 104L	Science Inquiry and Science Inquiry Lab	
HONS 201	Honors Human Nature	
HONS 217	Honors Special Topics: Mathematics	
HONS 220	Honors Christian Catholic Traditions	
HONS 221	Honor World or Global Religion	
HONS 241	Foundations of the West	
HONS 243	Asian&PacificIslanderAmerHist	
HONS 247	Honors Special Topics in History	
HONS 267	Honors Special Topics in Art	
HONS 287	Honors Special Topics in Literature	
HONS 301	Honors Ethics	
HONS 290	Honors Colloquium ²	3
HONS 390	Honors Colloquium ²	3

¹ These courses are cross-listed with regular University courses, and can fulfill core or major requirements.

² Course numbers may be repeated for credit.

In order to remain an Honors student in good standing, a student must:

1. Complete the Honors First Year Block (HONS 193 FYS; HONS 100 Multi-modal Communications, and PHIL 101H Reasoning: Honors) or the transfer equivalent within one academic year of joining the program.
2. Must either complete 6 credit hours of HONS courses (or courses with the Honors Designation) per academic year, or be within 12 credit hours of completing the Honors requirements. Exceptions will be made for students studying abroad during the academic year.
3. Must achieve a cumulative GPA of 3.3 at the time of graduation and good academic standing throughout their tenure at Gonzaga (as defined by the undergraduate catalogue). Students who drop below a 3.0 for two consecutive semesters will be removed from the program (subject to Director review).

Students who fail to meet these requirements will be removed from the program and will no longer qualify for the Honors scholarship.