# B.S. IN BIOMEDICAL ENGINEERING/M.S. IN INDUSTRIAL ENGINEERING

#### **Overview**

The College of Engineering offers a dual-degree program that culminates with students receiving a Bachelor of Science in Biomedical Engineering and a Master of Science in Industrial Engineering concurrently. This program is available only to qualified students enrolled in the undergraduate program in Biomedical Engineering at the University of Miami. This program is intended to give qualified Biomedical Engineering students the opportunity to acquire both a baccalaureate degree (BSBE) and a Master of Science (MSIE) degree in five years rather than the 4 plus 2 years (approximately) that is traditionally expected. The two degrees are awarded simultaneously when the combined requirements have been met for both degrees.

- Juniors enrolled in BME who have maintained at least a 3.0 CGPA have the option to apply for admission to the combined B.S. BME-M.S. IE program.
- Those who are accepted into this accelerated program must maintain at least a 3.0 CGPA and a minimum of a 3.0 GPA for the final 30 credit hours to meet the requirements of the Graduate School.
- Up to 6 credit hours of engineering electives earned during the fourth year can be counted toward the 30 credit hours required for the M.S. degree. If their schedule allows, students may be able to complete an additional 6 credits of graduate classes during their fourth year.
- · Students must be registered for a minimum of 12 undergraduate credit hours per semester in their fourth year.
- · Students can register for a maximum of 6 graduate credit hours in each semester of their fourth year.
- If a student needs to withdraw from the B.S. BME/M.S. IE program, then all the requirements for the BS degree must be completed for graduation with the B.S. BME degree.

## **Admission Requirements**

The dual B.S. BME/M.S. IE program is available only to qualified undergraduate students enrolled in the Department of Biomedical Engineering. Students must have undergraduate student status and a cumulative G.P.A. of at least 3.0 at the time of application.

Qualified students are strongly advised to apply to the dual degree program as early as possible in their junior year to facilitate academic advising and course selection in the second semester of their junior year. Students opting for an M.S. degree in a discipline different from their B.S. degree may need to take some prerequisite coursework. Before submitting an application, students should discuss the program and possibility of entering with an academic adviser.

## **Curriculum Guidelines**

In the dual-degree B.S. BME /M.S. IE program, the first four years of the curriculum are altered as follows:

- In the senior year, up to two 3-credit Undergraduate Engineering Electives can be replaced with 3-credit Graduate Engineering Electives
- If their schedule allows, students may be able to register for an additional 6 credits of graduate courses in the senior year.

In the fifth year, dual degree students complete their graduate course requirements.

Graduate Engineering Electives taken in the senior year must be chosen from dual-enrollment engineering course offerings, with the approval of their academic advisor. The credits of Graduate Engineering Electives completed in the fourth year are counted toward the 30 credits required for the MS degree.

Students admitted in the dual degree program can take a maximum of six (6) graduate credits per semester in their senior year, for a maximum of twelve (12) graduate credits per year, without incurring additional costs if they are full-time undergraduate students during this period. Students should register for courses towards their graduate degree as "G" credits and not as "U" credits. These registrations must be completed prior to taking courses. Retroactive add/drops will not be processed.

To register for graduate credits during their senior year, students must be in senior status and must complete and submit the Graduate School's Application for Undergraduates to Take Graduate Coursework (https://www.grad.miami.edu/policies-and-forms/forms/) form. This form must accompany the Add/Drop and/or Course Request form to ensure that students are registered with the correct registration status. Only students with a 3.0 CGPA will be permitted to register for graduate classes.

In the Senior year, students must be registered for a minimum of 12 undergraduate credits each semester to maintain full-time status as an undergraduate student. After completing the senior year, students must register as graduate students.

## **Graduation Requirements**

Students accepted into the dual degree program must maintain at least a 3.0 Cumulative GPA, and meet all other pertinent Graduate School requirements, including a minimum of 3.0 GPA in the credits applied toward the MS degree.

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# **Curriculum Requirements**

#### **BSBE/MSIE**

Students in the BSBE/MSIE program are required to complete the following courses for the dual degree::

Engineering)  Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation I)  BME 341 Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)  BME 341 Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)  BME 360 Applied Biotransport (NEW COURSE: Applied Biotransport) 3  BME 370 Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)  BME 375 Fundamentals of Biomechanics 3  BME 420 Capstone Project I (NEW COURSE: Capstone Project I) 3  BME 421 Capstone Project II (NEW COURSE: Capstone Project II) 3  BME 512 Regulatory Control of Biomedical Devices 3  Engineering Electives 9  Math and Science Courses  BIL 150 General Biology Aboratory 1  BME 265 Medical Systems Physiology 4  BME 310 Mathematical Analysis in Biomedical Engineering 3  BME 312 Biomedical Statistics and Data Analysis 1  CHM 113 Chemistry Laboratory I 1  CHM 121 Principles of Chemistry 4  MTH 151 Calculus II for Engineers 5  MTH 152 Calculus II Introduction to Ordinary Differential Equations 3  PHY 106 College Physics Laboratory I 1  Introduction to Ordinary Differential Equations 1  College Physics Laboratory I 1  Introduction to Ordinary Differential Equations 1  Analysis Applied Analysis Laboratory I 1  Biomedical Engineering 1  College Physics Laboratory I 1  Introduction to Ordinary Differential Equations 1	Code	Title	Credit Hours
Engineering Courses			
EGN 110   Innovation and Entrepreneurship in Engineering   1.3			
EEN 114         Global Challenges Addressed by Engineering and Technology         3           BME 112         Introduction to Biomedical Engineering         2           BME 211         Introduction to Programming for Biomedical Engineers         3           BME 221         Biomedical Design I (NEW COURSE: Biomedical Project I)         2           BME 222         Biomedical Design I (NEW COURSE: Biomedical Project II)         2           BME 321         Biomedical Project II (NEW COURSE: Biomedical Project II)         2           BME 322         Biomedical Project II (NEW COURSE: Biomedical Project II)         2           BME 335         Biomedical Engineering (NEW COURSE: Biomedical Project II)         3           BME 340         Medical Instrumentation II (NEW COURSE: Biomedical Signal Analysis Analysis)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Signal Analysis (NEW COURSE: Applied Biotransport)         3           BME 341         Medical Instrumentation III (NEW COURSE: Biomedical Signal Analysis (NEW COURSE: Capatone Project II)         3           BME 342         Applied Biotransport (NEW COURSE: Biomedical Signal Analysis (NEW COURSE: Capatone Project II)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Capatone Project II)         3           BME 371         Capatone Project II (NEW COURSE: Capatone Project II)         3 <td></td> <td>Innovation and Entrepreneurship in Engineering</td> <td>1-3</td>		Innovation and Entrepreneurship in Engineering	1-3
BME 112			
BME 211         Introduction to Programming for Biomedical Engineers         3           BME 221         Biomedical Design (NEW COURSE: Biomedical Design ()         1           BME 222         Biomedical Project (NEW COURSE: Biomedical Design II)         1           BME 321         Biomedical Project II (NEW COURSE: Biomedical Design II)         1           BME 322         Biomedical Project II (NEW COURSE: Biomedical Project II)         2           BME 335         Biomedical Project II (NEW COURSE: Biomedical Project II)         3           BME 336         Living Systems Engineering (NEW COURSE: Biomedical Instrumentation I)         4           BME 340         Medical Instrumentation I)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 360         Applied Biotransport (NEW COURSE: Biomedical Signal Analysis)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 420         Capstone Project II (NEW COURSE: Biomedical Signal Analysis)         3           BME 421         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         9           BME 510         General Biology			
BME 221   Biomedical Design I (NEW COURSE: Biomedical Project I)   2	BME 211		
BME 222         Biomedical Project I (NEW COURSE: Biomedical Project I)         2           BME 321         Biomedical Project II (NEW COURSE: Biomedical Design II)         1           BME 332         Biomedical Project II (NEW COURSE: Biomedical Project II)         2           BME 335         Biomaterials         3           BME 336         Living Systems Engineering (NEW COURSE: Living Systems Engineering)         3           BME 340         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 340         Applied Biotransport (NEW COURSE: Biomedical Signal Analysis)         3           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Signal Analysis)         3           BME 340         Applied Biotransport (NEW COURSE: Biomedical Signal Analysis)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 420         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 421         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         9           BME 30         General Biology         4           BIL 1			
BME 321   Biomedical Design II (NEW COURSE: Biomedical Design II)   1   1   1   1   1   1   1   1   1		- ,	
BME 322         Biomedical Project II (NEW COURSE: Biomedical Project II)         2           BME 335         Biomaterials         3           BME 336         Living Systems Engineering (NEW COURSE: Living Systems Engineering)         3           BME 340         Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation II)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 360         Applied Biotransport (NEW COURSE: Biomedical Signal Analysis)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 375         Fundamentals of Biomechanics         3           BME 420         Capatone Project I (NEW COURSE: Capatone Project II)         3           BME 421         Capatone Project II (NEW COURSE: Capatone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         General Biology         4           BML 151         General Biology Laboratory         1           BME 262         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Systems Physiology         4	BME 321	• • •	
BME 335         Biomaterials         3           BME 336         Living Systems Engineering (NEW COURSE: Living Systems Engineering (NEW COURSE: Biomedical Instrumentation I)         3           BME 340         Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation II)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 360         Applied Biotransport (NEW COURSE: Applied Biotransport)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 372         Fundamentals of Biomechanics         3           BME 420         Capatone Project I (NEW COURSE: Capatone Project I)         3           BME 421         Capatone Project II (NEW COURSE: Capatone Project II)         3           BME 512         Regulatory Control of Biomechanics         9           BME 512         Regulatory Control of Biomedical Devices         9           BME 310         General Biology         4           BIL 150         General Biology Laboratory         1           BME 312         Medical Systems Physiology         4           BME 313         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3 <tr< td=""><td></td><td></td><td></td></tr<>			
BME 336         Living Systems Engineering (NEW COURSE: Living Systems Engineering)         3           BME 340         Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation II)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 360         Applied Biotransport (NEW COURSE: Applied Biotransport)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 375         Fundamentals of Biomechanics         3           BME 420         Capstone Project II (NEW COURSE: Capstone Project I)         3           BME 421         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         9           Math and Science Courses         9           BIL 150         General Biology         4           BME 255         Medical Systems Physiology         4           BME 312         Biomedical Statistics and Data Analysis         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           PHY 101         Principles of Chemistry         4 <tr< td=""><td></td><td>• • •</td><td></td></tr<>		• • •	
BME 340         Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation I)         4           BME 341         Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)         3           BME 360         Applied Biotransport (NEW COURSE: Applied Biotransport)         3           BME 370         Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)         3           BME 375         Fundamentals of Biomechanics         3           BME 420         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         8           Math and Science Courses         9           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         4           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus II         4           MTH 194         University Physics I for the Scienc		Living Systems Engineering (NEW COURSE: Living Systems	3
Instrumentation II)	BME 340	Medical Instrumentation I (NEW COURSE: Biomedical	4
BIME 370 Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)  BME 375 Fundamentals of Biomechanics  BME 420 Capstone Project I (NEW COURSE: Capstone Project I)  3 BME 421 Capstone Project II (NEW COURSE: Capstone Project II)  3 BME 512 Regulatory Control of Biomedical Devices  3 Engineering Electives  Wath and Science Courses  BIL 150 General Biology  BIL 151 General Biology Laboratory  BIL 151 General Biology Laboratory  BIL 150 Metical Systems Physiology  Math Bin 265 Medical Systems Physiology  BME 312 Biomedical Statistics and Data Analysis  CHM 113 Chemistry Laboratory I  CHM 121 Principles of Chemistry  MTH 151 Calculus I for Engineers  MTH 162 Calculus I Introduction to Ordinary Differential Equations  PHY 201 University Physics I for the Sciences  Written Communication Skills:  WRS 105 First-Year Writing I  WRS 107 First-Year Writing II: STEM  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	BME 341		3
Analysis)  BME 375 Fundamentals of Biomechanics 3 BME 420 Capstone Project I (NEW COURSE: Capstone Project I) 3 BME 421 Capstone Project II (NEW COURSE: Capstone Project II) 3 BME 512 Regulatory Control of Biomedical Devices 3 Engineering Electives 9  Math and Science Courses  BIL 150 General Biology Abboratory 11 BME 265 Medical Systems Physiology 4 BME 310 Mathematical Analysis in Biomedical Engineering 3 BME 312 Biomedical Statistics and Data Analysis 3 BME 312 Biomedical Statistics and Data Analysis 3 BME 312 Biomedical Statistics and Data Analysis 3 BME 311 Child 13 Chemistry Laboratory 1 BME 151 Calculus I for Engineers 5 BMTH 151 Calculus II Introduction to Ordinary Differential Equations 3 BMF 311 Introduction The Sciences 4 BMF 311 Introduction The Sciences 3 BMF 312 University Physics I for the Sciences 4 BMF 301 The Sciences 3 BMF 301 The Science	BME 360	Applied Biotransport (NEW COURSE: Applied Biotransport)	3
BME 420         Capstone Project I (NEW COURSE: Capstone Project II)         3           BME 421         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Sengineering Electives         9           Math and Science Courses         8           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         1           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           CHM 121         Principles of Chemistry         4           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus II         4           MTH 311         Introduction to Ordinary Differential Equations         3           PHY 202         University Physics I for the Sciences         4           PHY 202         University Physics I for the Sciences         4           General Education Requirements         3           WRS 105         First-Year Writing I         3<	BME 370		3
BME 421         Capstone Project II (NEW COURSE: Capstone Project II)         3           BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         9           Math and Science Courses           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         1           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           CHM 121         Principles of Chemistry         4           MTH 151         Calculus I for Engineers         5           MTH 311         Introduction to Ordinary Differential Equations         3           PHY 202         College Physics Laboratory I         1           PHY 203         University Physics I for the Sciences         4           PHY 204         University Physics II for the Sciences         4           PHY 205         University Physics II for the Sciences         4           PHY 206         University Physics II for the Sciences         4           PHY 207         First-Year	BME 375	Fundamentals of Biomechanics	3
BME 512         Regulatory Control of Biomedical Devices         3           Engineering Electives         9           Math and Science Courses         9           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         11           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           CHM 121         Principles of Chemistry         4           MTH 151         Calculus I for Engineers         5           MTH 151         Calculus I for Engineers         5           MTH 31         Introduction to Ordinary Differential Equations         3           PHY 201         University Physics Laboratory I         1           PHY 202         University Physics I for the Sciences         4           PHY 202         University Physics II for the Sciences         4           WRS 105         First-Year Writing I         3           WRS 107         First-Year Writing II: STEM         3           Quantitative Skills:         Tirth Foundable of Engineers (fullfilled throu	BME 420	Capstone Project I (NEW COURSE: Capstone Project I)	3
Engineering Electives         9           Math and Science Courses           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         1           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           CHM 121         Principles of Chemistry         4           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus I         4           MTH 311         Introduction to Ordinary Differential Equations         3           PHY 201         University Physics I for the Sciences         4           PHY 202         University Physics I for the Sciences         4           PHY 202         University Physics II for the Sciences         4           Written Communication Skills:         Written Communication Skills:         3           WRS 105         First-Year Writing I         3           WRS 107         First-Year Writing II: STEM         3           Quantitative Skills:         A	BME 421	Capstone Project II (NEW COURSE: Capstone Project II)	3
Math and Science Courses           BIL 150         General Biology         4           BIL 151         General Biology Laboratory         1           BME 265         Medical Systems Physiology         4           BME 310         Mathematical Analysis in Biomedical Engineering         3           BME 312         Biomedical Statistics and Data Analysis         3           CHM 113         Chemistry Laboratory I         1           CHM 121         Principles of Chemistry         4           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus II         4           MTH 311         Introduction to Ordinary Differential Equations         3           PHY 106         College Physics Laboratory I         1           PHY 201         University Physics I for the Sciences         4           PHY 202         University Physics I for the Sciences         4           Ceneral Education Requirements         WRS 105         First-Year Writing I         3           WRS 105         First-Year Writing II: STEM         3           Quantitative Skills:         Amit 151         Calculus I for Engineers (fulfilled through the major)	BME 512	Regulatory Control of Biomedical Devices	3
BIL 150       General Biology       4         BIL 151       General Biology Laboratory       1         BME 265       Medical Systems Physiology       4         BME 310       Mathematical Analysis in Biomedical Engineering       3         BME 312       Biomedical Statistics and Data Analysis       3         CHM 113       Chemistry Laboratory I       1         CHM 121       Principles of Chemistry       4         MTH 151       Calculus I for Engineers       5         MTH 162       Calculus II       4         MTH 311       Introduction to Ordinary Differential Equations       3         PHY 106       College Physics Laboratory I       1         PHY 201       University Physics I for the Sciences       4         PHY 202       University Physics II for the Sciences       4         General Education Requirements       4         WRS 105       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       MTH 151       Calculus I for Engineers (fulfilled through the major)	Engineering Electives		9
BIL 151       General Biology Laboratory       1         BME 265       Medical Systems Physiology       4         BME 310       Mathematical Analysis in Biomedical Engineering       3         BME 312       Biomedical Statistics and Data Analysis       3         CHM 113       Chemistry Laboratory I       1         CHM 121       Principles of Chemistry       4         MTH 151       Calculus I for Engineers       5         MTH 162       Calculus II       4         MTH 311       Introduction to Ordinary Differential Equations       3         PHY 106       College Physics Laboratory I       1         PHY 201       University Physics I for the Sciences       4         PHY 202       University Physics II for the Sciences       4         General Education Requirements       4         Written Communication Skills:       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       MTH 151       Calculus I for Engineers (fulfilled through the major)	Math and Science Courses		
BME 265       Medical Systems Physiology       4         BME 310       Mathematical Analysis in Biomedical Engineering       3         BME 312       Biomedical Statistics and Data Analysis       3         CHM 113       Chemistry Laboratory I       1         CHM 121       Principles of Chemistry       4         MTH 151       Calculus I for Engineers       5         MTH 162       Calculus II       4         MTH 311       Introduction to Ordinary Differential Equations       3         PHY 106       College Physics Laboratory I       1         PHY 201       University Physics I for the Sciences       4         PHY 202       University Physics II for the Sciences       4         General Education Requirements       4         Written Communication Skills:       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       MTH 151       Calculus I for Engineers (fulfilled through the major)	BIL 150	General Biology	4
BME 265       Medical Systems Physiology       4         BME 310       Mathematical Analysis in Biomedical Engineering       3         BME 312       Biomedical Statistics and Data Analysis       3         CHM 113       Chemistry Laboratory I       1         CHM 121       Principles of Chemistry       4         MTH 151       Calculus I for Engineers       5         MTH 162       Calculus II       4         MTH 311       Introduction to Ordinary Differential Equations       3         PHY 106       College Physics Laboratory I       1         PHY 201       University Physics I for the Sciences       4         PHY 202       University Physics II for the Sciences       4         General Education Requirements       4         Written Communication Skills:       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       MTH 151       Calculus I for Engineers (fulfilled through the major)	BIL 151	General Biology Laboratory	1
BME 312 Biomedical Statistics and Data Analysis 3 CHM 113 Chemistry Laboratory I 1 CHM 121 Principles of Chemistry 4 MTH 151 Calculus I for Engineers 5 MTH 162 Calculus II 4 MTH 311 Introduction to Ordinary Differential Equations 3 PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	BME 265		4
BME 312 Biomedical Statistics and Data Analysis 3 CHM 113 Chemistry Laboratory I 1 CHM 121 Principles of Chemistry 4 MTH 151 Calculus I for Engineers 5 MTH 162 Calculus II 4 MTH 311 Introduction to Ordinary Differential Equations 3 PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	BME 310	Mathematical Analysis in Biomedical Engineering	3
CHM 121 Principles of Chemistry 4 MTH 151 Calculus I for Engineers 5 MTH 162 Calculus II 4 MTH 311 Introduction to Ordinary Differential Equations 3 PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	BME 312		3
MTH 151 Calculus I for Engineers  MTH 162 Calculus II  MTH 311 Introduction to Ordinary Differential Equations 3 PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills:  WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	CHM 113	Chemistry Laboratory I	1
MTH 162 Calculus II 4 MTH 311 Introduction to Ordinary Differential Equations 3 PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	CHM 121	Principles of Chemistry	4
MTH 311 Introduction to Ordinary Differential Equations  PHY 106 College Physics Laboratory I  PHY 201 University Physics I for the Sciences  4  PHY 202 University Physics II for the Sciences  4  General Education Requirements  Written Communication Skills:  WRS 105 First-Year Writing I  WRS 107 First-Year Writing II: STEM  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	MTH 151	Calculus I for Engineers	5
PHY 106 College Physics Laboratory I 1 PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	MTH 162	Calculus II	4
PHY 201 University Physics I for the Sciences 4 PHY 202 University Physics II for the Sciences 4  General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	MTH 311	Introduction to Ordinary Differential Equations	3
PHY 202 University Physics II for the Sciences 4  General Education Requirements  Written Communication Skills:  WRS 105 First-Year Writing I  WRS 107 First-Year Writing II: STEM 3  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	PHY 106	College Physics Laboratory I	1
General Education Requirements  Written Communication Skills:  WRS 105 First-Year Writing I 3  WRS 107 First-Year Writing II: STEM 3  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	PHY 201	University Physics I for the Sciences	4
Written Communication Skills:  WRS 105 First-Year Writing I 3  WRS 107 First-Year Writing II: STEM 3  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	PHY 202	University Physics II for the Sciences	4
WRS 105 First-Year Writing I 3 WRS 107 First-Year Writing II: STEM 3 Quantitative Skills: MTH 151 Calculus I for Engineers (fulfilled through the major)	General Education Requirements		
WRS 107 First-Year Writing II: STEM 3  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	Written Communication Skills:		
WRS 107 First-Year Writing II: STEM 3  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)	WRS 105	First-Year Writing I	3
Quantitative Skills:  MTH 151  Calculus I for Engineers (fulfilled through the major)	WRS 107		3
	Quantitative Skills:		
	MTH 151	Calculus I for Engineers (fulfilled through the major)	
	Areas of Knowledge:		

Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
MSIE REQUIREMENTS (30 CREDIT HOURS)		
Engineering electives taken as graduate courses		6
ISE 694	Master's Capstone Design Project	3
ISE 712	Design of Experiments	3
ISE 742	Linear Programming and Extensions	3
ISE 757	Ergonomics and Occupational Biomechanics	3
ISE 763	Project Management Techniques	3
or ISE 764	Supply Chain Management	
Three additional graduate courses		9
Total Credit Hours		152

# **Curriculum Requirements**

### **BSBE/MSIE (Pre-Med Track)**

Students in the BSBE/MSBE Pre-Med track complete the same core curriculum, with a special set of electives that meet the medical school admission requirements:

Code	Title	Credit Hours
BSBE REQUIREMENTS (133 CREDIT HOURS)		
Engineering Courses		
EGN 110	Innovation and Entrepreneurship in Engineering	1-3
EGN 114	Global Challenges Addressed by Engineering and Technology	3
BME 112	Introduction to Biomedical Engineering	2
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 221	Biomedical Design I (NEW COURSE: Biomedical Design I)	1
BME 222	Biomedical Project I (NEW COURSE: Biomedical Project I)	2
BME 321	Biomedical Design II (NEW COURSE: Biomedical Design II)	1
BME 322	Biomedical Project II (NEW COURSE: Biomedical Project II)	2
BME 335	Biomaterials	3
BME 336	Living Systems Engineering (NEW COURSE: Living Systems Engineering)	3
BME 340	Medical Instrumentation I (NEW COURSE: Biomedical Instrumentation I)	4
BME 341	Medical Instrumentation II (NEW COURSE: Biomedical Instrumentation II)	3
BME 360	Applied Biotransport (NEW COURSE: Applied Biotransport)	3
BME 370	Biomedical Signal Analysis (NEW COURSE: Biomedical Signal Analysis)	3
BME 375	Fundamentals of Biomechanics	3
BME 420	Capstone Project I (NEW COURSE: Capstone Project I)	3
BME 421	Capstone Project II (NEW COURSE: Capstone Project II)	3
BME 512	Regulatory Control of Biomedical Devices	3
Math and Science Courses		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
BMB 401	Biochemistry for the Biomedical Sciences	4
BME 265	Medical Systems Physiology	4
BME 310	Mathematical Analysis in Biomedical Engineering	3
BME 312	Biomedical Statistics and Data Analysis	3

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CHM 113	Chemistry Laboratory I	1
CHM 121	Principles of Chemistry	4
CHM 205	Chemical Dynamics Laboratory	1
CHM 206	Organic Reactions and Synthesis Laboratory	2
CHM 221	Introduction to Structure and Dynamics	4
CHM 222	Organic Reactions and Synthesis	4
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 106	College Physics Laboratory I	1
PHY 201	University Physics I for the Sciences	4
PHY 202	University Physics II for the Sciences	4
General Education Requirements		
Written Communication Skills:		
WRS 105	First-Year Writing I	3
WRS 107	First-Year Writing II: STEM	3
Quantitative Skills:		
MTH 151	Calculus I for Engineers (fulfilled through the major)	
Areas of Knowledge:		
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
MSIE REQUIREMENTS (30 CREDIT HOURS)		
ISE 694	Master's Capstone Design Project	3
ISE 712	Design of Experiments	3
ISE 742	Linear Programming and Extensions	3
ISE 757	Ergonomics and Occupational Biomechanics	3
ISE 763	Project Management Techniques	3
ISE 765	Advanced Production Systems	3
or ISE 764	Supply Chain Management	
Four additional graduate courses		12
Total Credit Hours		163

# **Suggested Plan of Study**

33	•	
Freshman Year		
Fall		Credit Hours
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
EGN 114	Global Challenges Addressed by Engineering and Technology	3
MTH 151	Calculus I for Engineers	5
WRS 105	First-Year Writing I	3
	Credit Hours	16
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 113	Chemistry Laboratory I	1
CHM 121	Principles of Chemistry	4
EGN 110	Innovation and Entrepreneurship in Engineering	1-3
MTH 162	Calculus II	4
WRS 107	First-Year Writing II: STEM	3
	Credit Hours	17

Sophomore Year		I
Fall		
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 221	Biomedical Design I	1
MTH 311	Introduction to Ordinary Differential Equations	-
		3
PHY 106	College Physics Laboratory I	1
PHY 201	University Physics I for the Sciences	4
PS/HA Cognate <sup>1</sup>	2 10.00	3
	Credit Hours	15
Spring		
BME 222	Biomedical Project I	2
BME 265	Medical Systems Physiology	4
BME 310	Mathematical Analysis in Biomedical Engineering	3
PHY 202	University Physics II for the Sciences	4
PS/HA Cognate <sup>1</sup>		3
	Credit Hours	16
Junior Year		
Fall		
BME 312	Biomedical Statistics and Data Analysis	3
BME 321	Biomedical Design II	1
BME 340	Medical Instrumentation I	4
BME 370	Biomedical Signal Analysis	3
BME 375	Fundamentals of Biomechanics	3
Engineering Elective <sup>2</sup>		3
	Credit Hours	17
Spring		
BME 322	Biomedical Project II	2
BME 335	Biomaterials	3
BME 341	Medical Instrumentation II	3
BME 360	Applied Biotransport	3
Engineering Elective <sup>2</sup>	, pp. 100 2 10 10 10 10 10 10 10 10 10 10 10 10 10	3
PS/HA Cognate <sup>1</sup>		3
r s, r in t sognate	Credit Hours	17
Senior Year	oreur riburs	''
Fall		
BME 336	Living Systems Engineering	3
BME 420	Capstone Project I	3
BME 512	Regulatory Control of Biomedical Devices	3
Graduate Engineering Elective <sup>3</sup>	negulatory Control of Biomedical Devices	
Graduate Course 4		3
PS/HA Cognate <sup>1</sup>		3
PS/HA Cognate	0. 1944	3
Our firm	Credit Hours	18
Spring		
BME 421	Capstone Project II	3
PS/HA Cognate <sup>1</sup>		3
PS/HA Cognate 1		3
Engineering Elective <sup>2</sup>		3
Graduate Engineering Elective <sup>3</sup>		3
Graduate Course <sup>4</sup>		3
	Credit Hours	18

Fifth Year (Graduate)		
Fall		
ISE 712	Design of Experiments	3
ISE 763	Project Management Techniques	3
ISE 742	Linear Programming and Extensions	3
	Credit Hours	9
Spring		
ISE 757	Ergonomics and Occupational Biomechanics	3
ISE 764	Supply Chain Management	3
ISE 694	Master's Capstone Design Project	3
	Credit Hours	9
	Total Credit Hours	152

- PS/HA Cognate: Students must complete a minimum of 1 People & Society (PS) cognate and 1 Humanities & Arts (HA) cognate, to be selected from the list of available cognates (https://cognates.miami.edu/). Each cognate should be a minimum of 3 courses (minimum of 9 credits).
- Students complete 15 credits of Engineering Electives, which can include a minor in another engineering discipline. Engineering Electives can be chosen from any BME or other engineering course offerings. Students should map their elective sequence in advance to ensure that electives taken in the junior year satisfy the pre-requisites of the electives that they wish to take in the senior year.
- Graduate Engineering Electives must be selected from 600 level dual-enrollment ISE course offerings.
- Graduate courses are 600 or 700 level courses chosen from the ISE course offerings with the approval of the advisor.

# **Suggested Plan of Study**

#### **Pre-Med Track**

Freshman Year		
Fall		Credit Hours
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
EGN 114	Global Challenges Addressed by Engineering and Technology	3
MTH 151	Calculus I for Engineers	5
WRS 105	First-Year Writing I	3
	Credit Hours	16
Spring		
BME 112	Introduction to Biomedical Engineering	2
CHM 113	Chemistry Laboratory I	1
CHM 121	Principles of Chemistry	4
EGN 110	Innovation and Entrepreneurship in Engineering	1-3
MTH 162	Calculus II	4
WRS 107	First-Year Writing II: STEM	3
	Credit Hours	17
Sophomore Year		
Fall		
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
BME 221	Biomedical Design I	1
CHM 205	Chemical Dynamics Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
MTH 311	Introduction to Ordinary Differential Equations	3
PS/HA Cognate <sup>1</sup>		3
	Credit Hours	17
Spring		
BME 211	Introduction to Programming for Biomedical Engineers	3
BME 222	Biomedical Project I	2

CHM 222  PHY 106  College Physics Laboratory I  PHY 201  University Physics I for the Sciences  PS/HA Cognate   Credit Hours  Junior Year  Fall  BMB 401  Biochemistry for the Biomedical Sciences  BME 265  Medical Systems Physiology  BME 310  Mathematical Analysis in Biomedical Engineering  BME 321  CHM 206  Organic Reactions and Synthesis Laboratory  PHY 202  University Physics II for the Sciences	4 1 4 3 17 4 4 4 3 1 2
PHY 201 University Physics I for the Sciences PS/HA Cognate   Credit Hours  Junior Year Fall  BMB 401 Biochemistry for the Biomedical Sciences BME 265 Medical Systems Physiology BME 310 Mathematical Analysis in Biomedical Engineering BME 321 Biomedical Design II CHM 206 Organic Reactions and Synthesis Laboratory	4 3 17 4 4 4 3 1 2
PS/HA Cognate   Credit Hours  Junior Year  Fall  BMB 401 Biochemistry for the Biomedical Sciences  BME 265 Medical Systems Physiology  BME 310 Mathematical Analysis in Biomedical Engineering  BME 321 Biomedical Design II  CHM 206 Organic Reactions and Synthesis Laboratory	3 17 4 4 3 1 2
Credit Hours  Junior Year  Fall  BMB 401 Biochemistry for the Biomedical Sciences  BME 265 Medical Systems Physiology  BME 310 Mathematical Analysis in Biomedical Engineering  BME 321 Biomedical Design II  CHM 206 Organic Reactions and Synthesis Laboratory	17 4 4 3 1 2
Junior Year  Fall  BMB 401 Biochemistry for the Biomedical Sciences  BME 265 Medical Systems Physiology  BME 310 Mathematical Analysis in Biomedical Engineering  BME 321 Biomedical Design II  CHM 206 Organic Reactions and Synthesis Laboratory	4 4 3 1 2
Fall  BMB 401 Biochemistry for the Biomedical Sciences  BME 265 Medical Systems Physiology  BME 310 Mathematical Analysis in Biomedical Engineering  BME 321 Biomedical Design II  CHM 206 Organic Reactions and Synthesis Laboratory	4 3 1 2
BMB 401 Biochemistry for the Biomedical Sciences BME 265 Medical Systems Physiology BME 310 Mathematical Analysis in Biomedical Engineering BME 321 Biomedical Design II CHM 206 Organic Reactions and Synthesis Laboratory	4 3 1 2
BME 265 Medical Systems Physiology BME 310 Mathematical Analysis in Biomedical Engineering BME 321 Biomedical Design II CHM 206 Organic Reactions and Synthesis Laboratory	4 3 1 2
BME 310 Mathematical Analysis in Biomedical Engineering BME 321 Biomedical Design II CHM 206 Organic Reactions and Synthesis Laboratory	3 1 2
BME 321 Biomedical Design II CHM 206 Organic Reactions and Synthesis Laboratory	1 2
CHM 206 Organic Reactions and Synthesis Laboratory	2
PHY 202 University Physics II for the Sciences	Δ
Credit Hours	18
Spring	
BME 312 Biomedical Statistics and Data Analysis	3
BME 322 Biomedical Project II	2
BME 335 Biomaterials	3
BME 340 Medical Instrumentation I	4
BME 370 Biomedical Signal Analysis	3
BME 375 Fundamentals of Biomechanics	3
Credit Hours	18
Senior Year	
Fall	
BME 336 Living Systems Engineering	3
BME 341 Medical Instrumentation II	3
BME 420 Capstone Project I	3
PS/HA Cognate 1	3
PS/HA Cognate <sup>1</sup>	3
Graduate Course <sup>2</sup>	3
Credit Hours	18
Spring	
BME 360 Applied Biotransport	3
BME 421 Capstone Project II	3
BME 512 Regulatory Control of Biomedical Devices	3
PS/HA Cognate	3
PS/HA Cognate 1	3
Graduate Course <sup>2</sup>	3
Credit Hours	18
Fifth Year (Graduate)	
Fall	
ISE 712 Design of Experiments	3
ISE 763 Project Management Techniques	3
ISE 742 Linear Programming and Extensions	3
Graduate Course	3
Credit Hours	12
Spring	
ISE 757 Ergonomics and Occupational Biomechanics	3
ISE 764 Supply Chain Management	3
ISE 694 Master's Capstone Design Project	3

Graduate Course <sup>2</sup>	3
Credit Hours	12
Total Credit Hours	163

PS/HA Cognate: Students must complete a minimum of 1 People & Society (PS) cognate and 1 Humanities & Arts (HA) cognate, to be selected from list of available cognates (https://cognates.miami.edu/). Each cognate should be a minimum of 3 courses (minimum of 9 credits). Students in Premed Track are highly encouraged to choose cognates that include PSY 110 and SOC 101.

<sup>&</sup>lt;sup>2</sup> Graduate courses are 600 or 700 level courses chosen from the ISE course offerings with the approval of the advisor.