Co-Terminal Degree Proposal

Bachelor of Science in Biomedical Engineering
Master of Science in Biology for the Health Professions

Undergraduate Program

Undergraduate Program Type: Bachelor of Science in Biomedical Engineering

Total Credit Hours (including shared credit): 131 hours (Cell and Tissue Engineering Track), 133 hours (Neural Engineering Track) 133 hours (Medical Imaging Track)

Program Description: The objective of the IIT undergraduate program in Biomedical Engineering (BME) facilitates the learning of biomedical engineering fundamentals. This foundation consists of a broad exposure to the biological and physical sciences, mathematics, and fundamental engineering content. In addition, students specialize in one of three BME areas: Cell and Tissue Engineering, Medical Imaging, or Neural Engineering. In all cases, students develop the skills necessary to succeed as professional biomedical engineers, and to thrive in graduate or professional school (e.g. medical school).

Program Purpose: The co-terminal program between the BS in Biomedical Engineering and MS in Biology for the Health Professions is intended for students who have chosen to pursue a career in the health professions. Many of the students at IIT enter with the intention of applying to health professions school upon graduation, and for these students additional education beyond the Bachelors degree is often not needed. However, a fraction of our pre-health students decide upon this career path later in their academic education and usually need additional coursework to prepare them for entrance exams such as the MCAT and/or coursework to improve the competitiveness of their application. In addition, it is often difficult for students to be ready to apply to a health professions school at the end of their U3 year in the Biomedical Engineering degree program due to the scheduling demands that exist in the curriculum. Furthermore, students also need significant hours of experiential learning to be competitive. The purpose of this program is to give students the additional coursework and time they will need for preparation for application to health professions schools.

Program Benefits: The benefit of the combined program is to provide students with further preparation for a successful application to a health profession school. Increasing the competitiveness of the applicant increases the likelihood of admission which in turn increases the success of the pre-health program at IIT.

Course requirements and sample curriculum: Specific pre-requisites (2 courses, 7 credit hours) have been added to prepare students for the Masters program. The sample curriculum is at the end of this document.

Competitive Programs: Many Universities offer a BS in Biomedical Engineering.

Market Analysis: None. This co-terminal combines two degrees already offered at IIT.

Marketing and Advertising: The co-terminal degree will be another tool that can be used to recruit UG students to IIT and will internally recruit students to stay for their Masters degree.

Enrollment Estimates: 0-5 students/year.

Retention Estimates: Retention should not be an issue as admittance to the program requires a proven track record of good academic standing.

Economic Analysis: No new costs. There is possible additional revenue in terms of 1 additional year UG tuition per student.

Graduate Program

Master of Science in Biology for the Health Professions

Program Overview: The MS in Biology for the Health Professions provides preparation for health professions schools including but not limited to Medicine, Dentistry, Pharmacy, and Optometry.

Program Justification: Some of IIT UGs need additional coursework to increase the competitiveness of the health professions school application. The co-terminal program is needed to allow students to increase their application credentials so that they may be more competitive in the applicant pool when they apply to medical school. It is estimated that 0-5 students/year will be interested in this program.

Program Resources: no additional resources, faculty or facilities, are needed.

Program description: A detailed list of courses, including shared courses, follows and can also be found here: http://science.iit.edu/programs/graduate/master-science-biology-health-professions . Students should have a GPA of 3.3 in order to apply with Spring 2018 being the first semester available for application.

Bachelor of Science in Biomedical Engineering/Master of Science in Biology for the Health Professions

Required Courses	Credit Hours UG	grad	total
Biomedical Engineering Core Requirements BME 100, 310, 315, 330, 405, 419, 422, 420, **433** [c], **453**[c]	26	6	26
Cell and Tissue Track Requirements[a] *BME 320, MMAE 200, ECE211, CHEM 237, CHEM239, CHE202, BME301, BME 335, BME418, **BME424**[c], BME482, BME electives (6ch)*	*38*	*3*	*38*
Neural Engineering Track Requirements[a] *BME 325, ECE211, ECE213, ECE218, BME309, CHEM 237, CHEM 239, BME438, BME443, **BME445**[c], BME electives (9ch)*	*40*	*3*	*40*
Medical Imaging Track Requirements[a] *BME 325, ECE211, ECE 213, CS201, ECE437, ECE481, BME309, BME438, BME443 **BME445**[c], CHEM 237, CHEM239, BME electives (3ch)*	*40*	*3*	*40*
Biology Requirements BIOL115, 117, *214*[b], *403*[b], 504, 515, 526, 527, 542, 544, 595, electives (4 credits)	11	23	34
Computer Science Requirements CS 104	2		2
Chemistry Requirements CHEM124, CHEM125	8		8
Mathematics Requirements MATH151, 152, 251, 252	18		18
Physics Requirements PHYS 123, 221	8		8
Humanities and Social Science Requirements	21		21
IPRO	6		6
Total	138-140	32	161-163

(131-132 BME UG) +7 (UG pre-req) +32 (MSHP) -9 (shared credits) = 161-163 (total)

[a]only one track is required for the BME UG program
[b]BIOL214 (3) and 403 (4) are required as pre-requisites for preparation for the MSHP
[c]shared courses between undergraduate and graduate curricula (9ch)

Doubles 9
BME453 (3) for BIOL530
BME433 for BIOL MS elective (3)
BME424 or 445 (3) for BIOL MS elective (3)

Sample Schedule: Cell and Tissue Track

Semester 1	Credits
BME 100 Introduction to the Profession	2
CHEM 124 Principles of Chemistry I	4
CS104 Intro to Programming for Engineers	2
MATH151 Calculus I	5
Humanities 200-level course	3
Total	**16**

Semester 2	
CHEM 125 Principles of Chemistry II	
MATH 152 Calculus II	
PHYS 123 General Physics I	
Humanities or Social Science Elective	
Total	

Semester 3	Credits
ECE 211 Circuit Analysis I	3
MATH 252 Introcution to Differential Equations	4
MMAE 200 Introduction to Mechanics	3
Hum/SS Elective	3
CHE 202 Material & Energy Balances	3
Total	**16**

Semester 4	
BIOL 115 Human Biology	
BIOL 117 Experimental Biology	
BME 315 Instrumentation Lab	
MATH 251 Mutivariate and Vector Calculus	
PHYS221 General Physics II: E&M	
Hum/SS elective	
Total	

Semester 5	Credits
BME 330 Analysis of Biosignals and Systems	3
BME 405 Physiology Laboratory	2
CHEM 237 Organic Chemistry I	4
BIOL 214 Genetics	3
BME 453 Quantitative Physiology	3
BME 422 Mathematical Methods in BME	3
Total	**18**

Semester 6	
BME 301 Bio-Fluid Mechanics	
BME 310 Biomaterials	
BME 320 Fluids Laboratory	
BME 335 Thermodynamics of Living Systems	
CHEM 239 Organic Chemistry II	
BIOL 403 Biochemistry Lectures	
Total	

Semester 7	
BME 418 Reaction Kinetics	3
BME 482 Mass Transport for BME	3
BME 419 Intro to Design Concepts in BME	2
BIOL 515 Molecular Biology	3
BME 433 Applications of Statistics	3
BIOL 544 Molecular Biology of the Cell	3
Total	**17**

Semester 8	
BME 420 Design concepts in BME	
BME 424 Quantitative Aspects of Cell & Tissue Eng	
BIOL 504 Biochemistry Lecture	
IPRO II	
BIOL 595 Biology Colloquium	
Total	

Semester 9	
IPRO I	3
BME Elective	3
BIOL 527 Immunology and Immunohistochemistry	3
BIOL 542 Advanced Microbiology Lectures	3
HUM/SS	3
Total	**15**

Semester 10	
BME Elective	
BIOL 526 Development	
BIOL 5xx Elective	
Hum/SS Elective	
BIOL 595 Biology Colloquium	
Hum/SS Elective	
Total	

Shared Credits (9 credit hours) : BME 453, BME 433, BME 424

Sample Schedule – Medical Imaging

Semester 1	Credits
BME 100 Introduction to the Profession	2
CHEM 124 Principles of Chemistry I	4
CS104 Intro to Programming for Engineers	2
MATH151 Calculus I	5
Humanities 200-level course	3
Total	**16**

Semester 2
CHEM 125 Principles of Chemistry II
MATH 152 Calculus II
PHYS 123 General Physics I
Humanities or Social Science Elective
Total

Semester 3	Credits
CS 201	4
MATH 252 Introcution to Differential Equations	4
PHYS 221	4
ECE 211 Circuit Analysis I	3
HUM/SS	3
Total	**18**

Semester 4
BIOL 115 Human Biology
BIOL 117 Experimental Biology
BME 315 Instrumentation Lab
MATH 251 Mutivariate and Vector Calculus
ECE 213 Circuit Analysis II+lab
Hum/SS
Total

Semester 5	Credits
BME 330 Analysis of Biosignals and Systems	3
BME 405 Physiology Laboratory	2
BME 309 Imaging and Sensing	3
BIOL 214 Genetics	3
BME 453 Quantitative Physiology	3
BME 422 Mathematical Methods in BME	3
Total	**17**

Semester 6
BME 310 Biomaterials
BME 325 Bioelectronics Lab
BME 443 Biomed Instrumentation & Electronics
BME 445 Quantitative Neural Function
CHEM 237 Organic Chemistry I
IPRO I
Total

Semester 7
CHEM 239 3
BME 419 Intro to Design Concepts in BME 2
BIOL 515 Molecular Biology 3
BME 433 Applications of Statistics 3
BIOL 544 Molecular Biology of the Cell 3
ECE 437 Digital Signal Processing 3
Total 17

Semester 8
BME 420 Design concepts in BME
BME 438 Neuro Imaging
BIOL 403
BIOL 595 Biology Colloquium
Hum/SS Elective
ECE 481 Image Processing
Total

Semester 9
HUM/SS 3
BME Elective 3
BIOL 527 Immunology and Immunohistochemistry 3
BIOL 542 Advanced Microbiology Lectures 3
IPRO II 3
Total 15

Semester 10
BIOL 526 Development
BIOL 5xx Elective
Hum/SS Elective
BIOL 595 Biology Colloquium
BIOL 504 Biochemistry Lecture
Total

Shared Credits (9 credit hours) : BME 453, BME 433, BME 445

Sample Schedule – Neural Engineering

Semester 1	**Credits**
BME 100 Introduction to the Profession	2
CHEM 124 Principles of Chemistry I	4
CS104 Intro to Programming for Engineers	2
MATH151 Calculus I	5
Humanities 200-level course	3
Total	**16**

Semester 2
CHEM 125 Principles of Chemistry II
MATH 152 Calculus II
PHYS 123 General Physics I
Humanities or Social Science Elective
Total

Semester 3	**Credits**
ECE 211 Circuit Analysis I	3
MATH 252 Introcution to Differential Equations	4
PHYS 221	4
ECE 218 Digital Systems+Lab	4
HUM/SS	3
Total	**18**

Semester 4
BIOL 115 Human Biology
BIOL 117 Experimental Biology
BME 315 Instrumentation Lab
MATH 251 Mutivariate and Vector Calculus
ECE 213 Circuit Analysis II+lab
Hum/SS elective
Total

Semester 5	**Credits**
BME 330 Analysis of Biosignals and Systems	3
BME 405 Physiology Laboratory	2
BME 309 Imaging and Sensing	3
BIOL 214 Genetics	3
BME 453 Quantitative Physiology	3
BME 422 Mathematical Methods in BME	3
Total	**17**

Semester 6
BME 310 Biomaterials
BME 325 Bioelectronics Lab
BME 443 Biomed Instrumentation & Electronics
BME 445 Quantitative Neural Function
CHEM 237 Organic Chemistry I
IPRO I
Total

Semester 7	
CHEM 239	3
BME 419 Intro to Design Concepts in BME	2
BIOL 515 Molecular Biology	3
BME 433 Applications of Statistics	3
BIOL 544 Molecular Biology of the Cell	3
IPRO II	3
Total	**17**

Semester 8
BME 420 Design concepts in BME
BME 438 Neuro Imaging
BIOL 403
BIOL 595 Biology Colloquium
Hum/SS Elective
Total

Semester 9	
HUM/SS	3
BME Elective	3
BIOL 527 Immunology and Immunohistochemistry	3
BIOL 542 Advanced Microbiology Lectures	3
BME Elective	3
Total	**15**

Semester 10
BME Elective
BIOL 526 Development
BIOL 5xx Elective
Hum/SS Elective
BIOL 595 Biology Colloquium
BIOL 504 Biochemistry Lecture
Total

Shared Credits (9 credit hours) : BME 453, BME 433, BME 445