

Co-Terminal Degree Proposal, Form 802 Attachment

Bachelor of Science in Biomedical Engineering

Master of Pharmaceutical engineering

Undergraduate Program

Undergraduate Program Type: Bachelor of Science in Biomedical Engineering, Cell & Tissue Engineering Track

Total Undergraduate Program Credit Hours (including shared credit): 132-133 hours

Program Description: IIT's 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, business, law).

Program Purpose: The co-terminal program between the BS in Biomedical Engineering and Master of Pharmaceutical Engineering (MPE) allows students interested in future careers in pharmaceutical engineering to enter the job force very competitively positioned to pursue opportunities in pharmaceutical companies and other life sciences industries.

Program Benefits: The Master of Pharmaceutical Engineering degree was one of six new interdisciplinary engineering degrees approved for Fall 2017. These interdisciplinary degrees reflect contemporary shifts in engineering education and increase the attractiveness of IIT with potential graduate students. By offering these new interdisciplinary graduate degrees as co-terminal programs with our current undergraduate degrees, we are providing our current undergraduate engineering students a path to greater competitiveness while they retain undergraduate financial aid benefits. Furthermore, engineering transfer students often face significant course sequencing challenges within engineering curriculums. Some transfer students solve this problem by pursuing co-terminal programs, and some choose to leave IIT. This co-terminal program will increase the options available to transfer students and potentially improve retention.

Course requirements and sample curriculum: Course requirements and a sample curriculum are included in this document.

Competitive Programs: BS BME is a competitive degree offered by many institutions. However, most schools do not offer a co-terminal BS BME and graduate pharmaceutical engineering.

Market Analysis: BS BME is a competitive degree offered by many institutions. The Master of Pharmaceutical Engineering is a new degree program (Fall 2017). Please refer to the market analysis for the MPE degree provided in the 2017 degree program application for further information.

Marketing and Advertising: Both degrees are currently marketed. The co-terminal degree will be included in current co-terminal degree marketing and additional marketing by the Armour College of Engineering.

Enrollment Estimates: Estimated enrollment in this co-terminal program is 2-4 new students/year.

Retention Estimates: It is anticipated that retention may be improved for transfer students as the co-terminal program allows more flexibility for scheduling each semester.

Economic Analysis: There are no additional costs for the co-terminal program. It is expected that this co-terminal program will draw from a group of students separate from those who pursue the other BME co-terminal programs. Therefore, it is expected that additional tuition revenue will be generated equivalent to 24 credits/student enrolled in the program.

Graduate Program

Graduate Program: Master of Pharmaceutical engineering

Program Overview: In the Master of Pharmaceutical Engineering program, students first learn the basics of pharmaceutical engineering, drug delivery, bioprocess engineering, and entrepreneurship/intellectual property management before selecting from elective courses covering topics ranging from crystal growth to cardiovascular fluid mechanics to nanoscale imaging.

Program Justification: The Armour College of Engineering is committed to be a lifelong educational partner with our community, from pre-college to professional advancement. The MPE degree program contributes to this commitment by enhancing the overall offerings within the Armour College of Engineering. It is anticipated that approximately 20 students will enroll in the MPE program Fall 2018. The co-terminal degree is anticipated to add 2-8 additional students. A detailed justification for the MPE program can be found in the 2017 MPE degree application.

Program Resources: The co-terminal program does not require additional resources. The MPE curriculum includes existing courses and a few new courses that will be developed and delivered according to program demand.

Program description: A detailed list of courses required for each track in the co-terminal degree follows. Students should have a 3.0 GPA in order to be accepted into the co-terminal program. Students will be accepted into the program beginning Fall 2018.

Description of courses shared between Undergraduate and Graduate programs:

a) Shared required courses: none

b) Shared elective courses:

UG: (2) BME Electives as GRAD: (2) MPE Core courses or electives

c) Course substitutions or exceptions: none

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Required Courses

	Credit Hours		
	<i>UG</i>	<i>grad</i>	<i>total</i>
Biomedical Engineering Core Requirements BME 100, 310, 315, 330, 405, 419, 422, 420, 433, 453	26	0	26
Cell and Tissue Track Requirements^a BME 301, 320, 335, 418, 424, 482, BME electives^c (6 cr) CHE 202, MMAE 200, ECE 211, CHEM 235, BIOL 403	32	0	38
Master of Pharmaceutical Engineering Core Requirements^a CHE 583, 585, 577, 506	3	12	12
Master of Pharmaceutical Engineering Electives^a (select 18 cr) CHE 426, 560, 545, 580, 551, 508, 582, 594, 593, MMAE 519, 556, 561, BIOL 515, BME 525, 516, 502 (others by approval)	3	18	18
Science Requirements BIOL 115, BIOL 117, CHEM 124, CHEM 125, PHYS 123, PHYS 221	20	0	20
Mathematics & Computer Science Requirements MATH 151, MATH 152, MATH 251, MATH 252, CS 104	20	0	20
Mathematics Requirements MATH 151, MATH 152, MATH 251, MATH 252	18	0	18
Humanities and Social Science Requirements	21	0	21
I PRO	6	0	6
Total (131-132 BME UG) + 30 (MPE) -6 (shared credits) = 155-156 (total)	131-132	30	155-156

^ashared courses between undergraduate and graduate curricula (6 cr)

(2) UG Technical Electives fulfilled by (2) Core or elective MPE courses

Sample Schedule

Semester 1	Credits	Semester 2	Credits
BME 100 Introduction to the Profession	2	CHEM 125 Principles of Chemistry II	4
CHEM 124 Principles of Chemistry I	4	MATH 152 Calculus II	5
CS104 Intro to Programming for Engineers	2	PHYS 123 General Physics I	4
MATH151 Calculus I	5	Hum/SS Elective	3
Hum/SS Elective	3		
Total	16	Total	16
Semester 3	Credits	Semester 4	Credits
CHE 202 Material & Energy Balances	3	BIOL 115 Human Biology	3
ECE 211 Circuit Analysis I	3	BIOL 117 Experimental Biology	1
MATH 252 Introduction to Differential Equations	4	BME 315 Instrumentation Lab	2
MMAE 200 Introduction to Mechanics	3	MATH 251 Multivariate and Vector Calculus	4
Hum/SS Elective	3	PHYS 221 Physics II: EM and Optics	4
		Hum/SS Elective	3
Total	16	Total	17
Semester 5	Credits	Semester 6	Credits
BME 330 Analysis of Biosignals and Systems	3	BME 301 Biofluid Mechanics	3
BME 405 Physiology Laboratory	2	BME 310 Biomaterials	3
BME 422 Mathematical Methods in BME	3	BME 320 Biofluids Laboratory	1
BME 453 Quantitative Physiology	3	BME 335 Thermodynamics of Living Systems	3
CHEM 235/237 Organic Chemistry I	3/4	BIOL 403 Biochemistry	4
Hum/SS Elective	3	IPRO I	3
Total	17/18	Total	17
Semester 7		Semester 8	
BME 418 Reaction Kinetics	3	BME 420 Design concepts in BME	3
BME 419 Intro to Design Concepts in BME	2	BME 424 Quant. Aspects of Tissue Engineering	3
BME 482 Mass Transport for BME	3	CHE 585 Drug Delivery	3
CHE 577 Bioprocess Engineering	3	CHE 583 Introduction to Pharmaceutical Eng	3
		Senior Seminar	0
CHE 506 Entrepreneurship and Intellectual Property Management	3	MPE Elective	3
Total	14	Total	15
Semester 9		Semester 10	
BME 433 Applications of Statistics	3	IPRO II	3
Social Science Elective (300+)	3	MPE Elective	3
MPE Elective	3	MPE Elective	3
MPE Elective	3	Hum/SS Elective	3
MPE Elective	3		
Total	15	Total	12