

## **Co-Terminal Degree Proposal, Form 802 Attachment**

**Bachelor of Science in Computer Engineering**

**Master of Computational Engineering**

### **Undergraduate Program**

Undergraduate Program Type: Bachelor of Science in Computer Engineering

Total Undergraduate Program Credit Hours (including shared credit): 131-134 hours

Program Description: Computer engineering involves the design and application of computer hardware and computer software. Computer hardware consists of the physical components that implement a computer system: processor and memory chips, circuit boards, and peripheral devices. Computer software consists of computer programs that accomplish a specific task using sequences of simple, programmable steps. Computers have become an integral part of many large systems that require sophisticated control, including automobiles, medical instrumentation, telecommunication systems, and factory automation. Computers are a driving force behind many of today's exciting new technologies, including wireless communications, interactive multimedia, and high-speed computer networks. Computer engineers must have detailed knowledge of both hardware and software to design, build, and use complex information processing systems for a wide range of applications.

Program Purpose: The co-terminal program between the BS in Computer Engineering and Master of Computational Engineering (MCE) allows students interested in future careers focused in computational aspects of engineering to enter the job force very competitively positioned to pursue these opportunities within engineering-based industries.

Program Benefits: The Master of Computational 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 CPE is a competitive degree offered by many institutions. However, most schools do not offer a co-terminal BS CPE and graduate degree in computational engineering.

Market Analysis: BS CPE is a competitive degree offered by many institutions. The Master of Computational Engineering is a new degree program (Fall 2017). Please refer to the market analysis for the MCE 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 4-8 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 CPE 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 Computational Engineering

Program Overview: Students who thrive on solving complex equations and are energized by delving into computer simulations and mathematical algorithms would be a good fit for the Master of Computational Engineering program. This new and growing multidisciplinary field offers career possibilities ranging from calculating the trajectory of satellites to designing aircraft to simulating molecular mechanics. Students will learn computational methodologies, tools, analysis, processing, and modeling capabilities that are central to succeeding in this dynamic engineering field. There are four tracks: (a) Computational Mechanics, (b) Computational Chemical Engineering, (c) Biomedicine, or (d) Optimization, Machine Vision, and Decision Making.

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 MCE 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 MCE program Fall 2018. The BS CPE/MCE co-terminal degree is anticipated to add 4-8 additional students. A detailed justification for the MCE program can be found in the 2017 MCE degree application.

Program Resources: The co-terminal program does not require additional resources. The MCE curriculum leverages existing courses.

Program description: A detailed list of courses required for each track in the co-terminal degree follows. Students should have a minimum 3.0 GPA 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:

UG: (2) ECE Professional Elective as GRAD: ECE 505, 511

b) Shared elective courses: none

c) Course substitutions or exceptions: none

## Bachelor of Science in Computer Engineering/Master of Computational Engineering

Required Courses	Credit Hours		
	<i>UG</i>	<i>grad</i>	<i>total</i>
<b>Computer Engineering Core Requirements</b> ECE 100, 211, 213, 218, 242, 308, 311,	18	0	18
<b>Master of Computational Engineering Core Requirements<sup>b</sup></b> (3 courses) <b>ECE 505, ECE 511</b> , MMAE 501, MMAE 502, MMAE 451, MMAE 532, CHE 506, CHE 536, MATH 577, MATH 581, BME 522, BME 553	6	9	9
<b>Computational Mechanics Specialization<sup>a</sup></b> (4 courses) MMAE 450, MMAE 517, MMAE 518, MMAE 570, MMAE 532, CAE 530, CAE 534 CAE 535, CAE 536, CHE 536, CHE 560, MMAE 597, CAE 597	0	12	12
<b>Computational Chemical Engineering Specialization<sup>a</sup></b> (4 courses) CHE 439, CHE 535, CHE 536, CHE 597	0	12	12
<b>Biomedicine Specialization<sup>a</sup></b> (4 courses) BME 445, BME 523, BME 524, BME 525, BME 538, BME 597, ECE 565, CHE 585, CHE 516/BME 517	0	12	12
<b>Optimization, Machine Vision, and Decision Making Specialization<sup>a</sup></b> (4 courses) ECE 533, ECE 535, ECE 563, ECE 565, ECE 567	0	12	12
<b>Master of Computational Engineering Elective Requirements</b> (3 courses) Additional courses from core or any specialization	3	6	9
<b>Computer Science Major Requirement</b> CS 115, 116, 330, 331, 351, 450	16	0	16
<b>Physics Requirements</b> PHYS 123, 221, 224	11	0	11
<b>Chemistry Requirements</b> CHEM 122	3	0	3
<b>Computer System/ Software Elective</b> ECE 408	3	0	3
<b>Junior Computer Engineering Elective</b> ECE 308	3	0	3
<b>Professional ECE Elective</b>	7	6	0
<b>Hardware Design Elective</b> ECE 429 or ECE 446	4	0	4

<b>Engineering Science Requirement</b> MMAE 200 or 320	3	0	3
<b>Science Elective</b> BIOL 105, 114, CHEM 126, MS 201	3	0	3
<b>Mathematics Requirements</b> MATH 151, 152, 251, 252, 333 or 350, 374	24	0	24
<b>Humanities and Social Science Requirements</b>	21	0	21
<b>I PRO</b>	6	0	6
Total	131	30	155

(131 CPE UG) + 30 (MCE) - 6 (shared credits) = 155 (total)

<sup>b</sup>only one track is required for the MCE program

<sup>b</sup>shared courses between undergraduate and graduate curricula (6 cr)  
ECE 505 and ECE 511

### ***Sample Schedule***

<b>Semester 1</b>	<b>Credits</b>	<b>Semester 2</b>	<b>Credits</b>
ECE 100	3	MATH 152	5
MATH 151	5	PHYS 123	4
CHEM 122	3	CS 116	2
CS 115	2	Science Elective	3
Humanities 200- level Course	3	Social Science Elective	3
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>17</b>
<b>Semester 3</b>	<b>Credits</b>	<b>Semester 4</b>	<b>Credits</b>
MATH 252	4	MATH 251	4
PHYS 221	4	PHYS 224	3
ECE 211	3	ECE 213	4
ECE 218	4	ECE 242	3
CS 331	3	CS 330	3
<b>Total</b>	<b>18</b>	<b>Total</b>	<b>17</b>
<b>Semester 5</b>	<b>Credits</b>	<b>Semester 6</b>	<b>Credits</b>
ECE 311	4	CS 450	3
CS 351	3	MATH 374	3
MMAE 200 or 300	3	ECE 308	3
MATH 333 or 350	3	IPRO Elective I	3
Humanities Elective (300+)	3	Social Science Elective (300+)	3
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>15</b>
<b>Semester 7</b>		<b>Semester 8</b>	
ECE 441	4	ECE 429 or 446	4
ECE 485	3	MCE Elective	3
ECE 505 (MCE Core)	3	MCE Specialization	3
MCE Specialization	3	HUM Elective (300+)	3
MCE Elective	3		
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>13</b>
<b>Semester 9</b>		<b>Semester 10</b>	
ECE 511 (MCE Core)	3	IPRO Elective II	3
ECE 408	3	MCE Specialization	3
MCE Specialization	3	MCE Elective	3
MCE Core	3	Social Science Elective (300+)	3
Hum/ SS Elective	3		
<b>Total</b>	<b>15</b>	<b>Total</b>	<b>12</b>