MSOE Computer Engineering v5.0
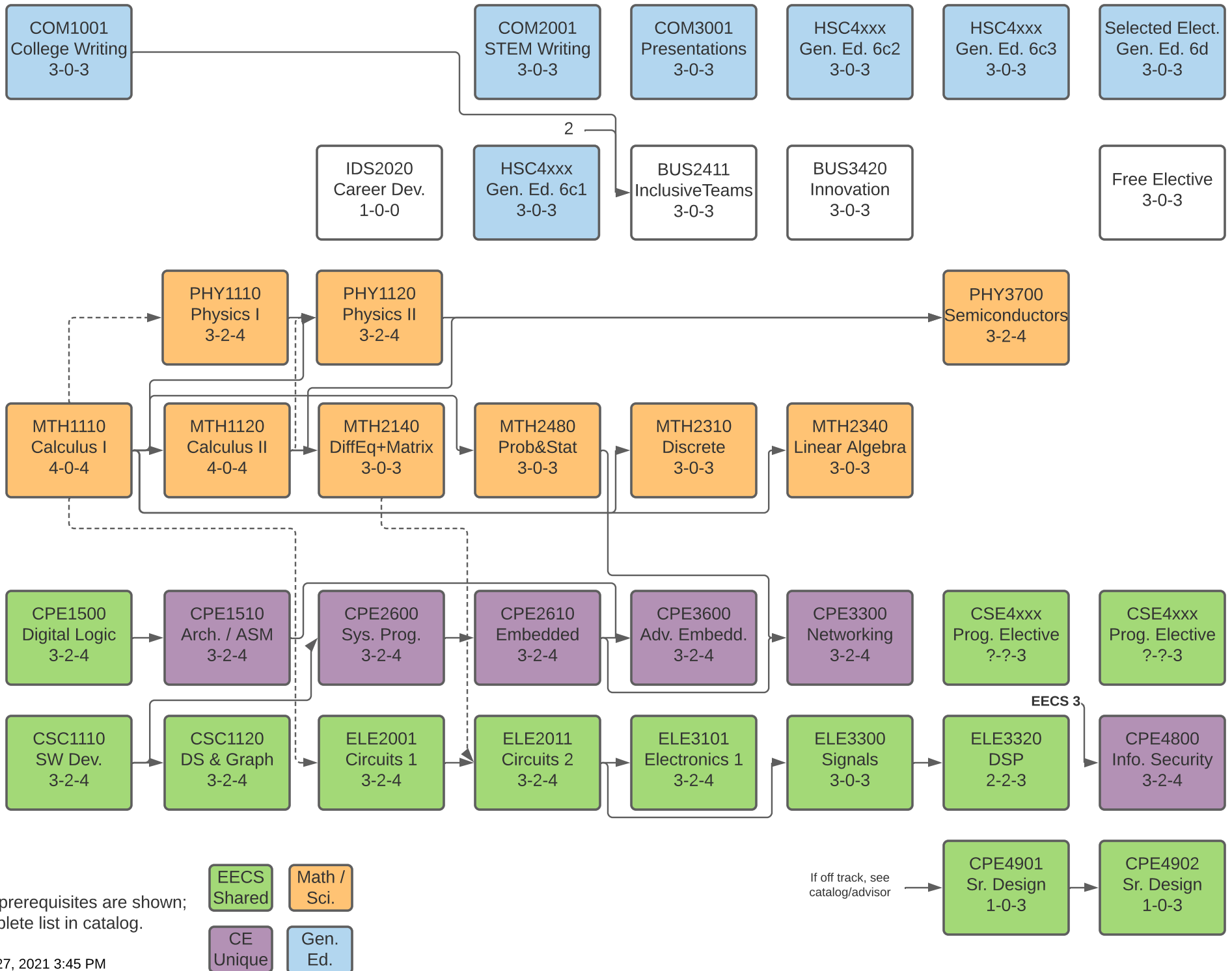
Semester Curriculum Proposal

Contents

- Flowchart
- Track
- Correspondences between old and new curricula
- CPE section counts by semester
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References

- Flowchart: https://lucid.app/documents/view/939acc0f-6ef6-41cd-890c-1d0778a13669
- Most Development Materials:
  %USERPROFILE%\Box\EECS Faculty and Staff\Program Specific\CE\Curriculum
- Collaborative Development Notes (CE faculty; request access if needed):
  %USERPROFILE%\OneDrive\OneDrive - Milwaukee School of Engineering\CE Curriculum

MSOE CE Curriculum v5.0 for F'23+ Students

COM1001
College Writing
3-0-3

COM2001
STEM Writing
3-0-3

COM3001
Presentations
3-0-3

HSC4xxx
Gen. Ed. 6c2
3-0-3

HSC4xxx
Gen. Ed. 6c3
3-0-3

Selected Elect.
Gen. Ed. 6d
3-0-3

2

IDS2020
Career Dev.
1-0-0

HSC4xxx
Gen. Ed. 6c1
3-0-3

BUS2411
InclusiveTeams
3-0-3

BUS3420
Innovation
3-0-3

Free Elective
3-0-3

PHY1110
Physics I
3-2-4

PHY1120
Physics II
3-2-4

PHY3700
Semiconductors
3-2-4

MTH1110
Calculus I
4-0-4

MTH1120
Calculus II
4-0-4

MTH2140
DiffEq+Matrix
3-0-3

MTH2480
Prob&Stat
3-0-3

MTH2310
Discrete
3-0-3

MTH2340
Linear Algebra
3-0-3

CPE1500
Digital Logic
3-2-4

CPE1510
Arch. / ASM
3-2-4

CPE2600
Sys. Prog.
3-2-4

CPE2610
Embedded
3-2-4

CPE3600
Adv. Embedd.
3-2-4

CPE3300
Networking
3-2-4

CSE4xxx
Prog. Elective
?-?-3

CSE4xxx
Prog. Elective
?-?-3

CSC1110
SW Dev.
3-2-4

CSC1120
DS & Graph
3-2-4

ELE2001
Circuits 1
3-2-4

ELE2011
Circuits 2
3-2-4

ELE3101
Electronics 1
3-2-4

ELE3300
Signals
3-0-3

ELE3320
DSP
2-2-3

EECS 3

CPE4800
Info. Security
3-2-4

If off track, see
catalog/advisor

CPE4901
Sr. Design
1-0-3

CPE4902
Sr. Design
1-0-3

Key prerequisites are shown;
complete list in catalog.

EECS
Shared

Math /
Sci.

CE
Unique

Gen.
Ed.

Oct 27, 2021 3:45 PM

[student name]

Student ID
[date]
Last Revision by Dr. Durant
CE 5.0
Curriculum Version
Plan to complete CE degree

Fall, 2023

Code	Course	Hours	Credits
COM-1001	College Writing	3	3
CPE-1500	Digital Logic	5	4
CSC-1110	Software Development	5	4
MTH-1110	Calculus I	4	4
Total		**17**	**15**

Spring, 2024

Code	Course	Hours	Credits		
CPE-1510	Computer Architecture and Assembly	5	4		
CSC-1120	Data Structures and Graphical Interfa	5	4		
MTH-1120	Calculus II	4	4		
PHY-1110	Physics I - Mechanics & Thermodyna	5	4		
Total		**19**	**16**	**36**	**31**

Fall, 2024

Code	Course	Hours	Credits
CPE-2600	Systems Programming	5	4
ELE-2001	Electric Circuits 1: Theory and App	5	4
IDS-2020	Career Development	1	0
MTH-2140	Diff Eq + Matrix Algebra	3	3
PHY-1120	Physics II - Electricity, Magnetism,	5	4
Total		**19**	**15**

Spring, 2025

Code	Course	Hours	Credits		
COM-2001	Writing for the STEM Disciplines	3	3		
CPE-2610	Embedded Systems	5	4		
ELE-2011	Electric Circuits 2: Theory and Applica	5	4		
HSC-4	GenEd SE HSC (6c)	3	3		
MTH-2480	Probability and statistics	3	3		
Total		**19**	**17**	**38**	**32**

Fall, 2025

Code	Course	Hours	Credits
BUS-2411	Building Inclusive Teams	3	3
COM-3001	Professional Presentations	3	3
CPE-3600	Advanced Embedded Systems	5	4
ELE-3101	Electronics 1	5	4
MTH-2310	Discrete Math	3	3
Total		**19**	**17**

Spring, 2026

Code	Course	Hours	Credits		
BUS-3420	Innovation and Entrepreneurship	3	3		
CPE-3300	Networking	5	4		
ELE-3300	Signals and Systems	3	3		
HSC-4	GenEd SE HSC (6c)	3	3		
MTH-2340	Linear algebra with applications	3	3		
Total		**17**	**16**	**36**	**33**

Fall, 2026

Code	Course	Hours	Credits
CPE-4901	Senior Design 1	2	3
CSE-4	Program Elective	3	3
ELE-3320	Digital Signal Processing	4	3
HSC-4	GenEd SE HSC (6c)	3	3
PHY-3700	Physics of Electronic Materials and	5	4
Total		**17**	**16**

Spring, 2027

Code	Course	Hours	Credits		
CPE-4800	Information Security	5	4		
CPE-4902	Senior Design 2	2	3		
CSE-4	Program Elective	3	3		
EL	Free Elective	3	3		
HSC-4	GenEd SE HSC/MA/PH/CH (6d)	3	3		
Total		**16**	**16**	**33**	**32**
				143	**128**

General Education Core Part 1, 21 credits required	21
ABET Math/Science, 30 required	32
EECS (shared) classes highlighted to help assess balance	
EECS (CE only) classes highlighted to help assess balance	

Bachelor of Science
Computer Engineering
Model Full-Time Track - V4.3 (from 2020-2021 catalog)

Course Number	Course Name	QF	QW	QS	CE Q	Quarter System Count	Lec Hours	Lab Hours	Credits	Has Lab	Area	SE Count	Lec Hours	Lab Hours	Credits	SA Count	Lec Hou	Lab Hou	Credits	Δ Credits	Course #	Course Name
	Total					55	168	48	192	24		36.7	112	32	128	37	111	36	128			
																1%	-1%	13%	0% ←↓% Δ			
						3	9	0	9		Business	2	6.0		6	2	6	0	6	0%		
						9	27	12	33	6	Engineering CS	6	18.0	8.0	22	5	15	8	19	-14%		
						17	49	28	63	14	Engineering EC	11.3	32.7	18.7	42	13	36	22	47	12%		
						3	7	0	7		General	2	4.7		4.7	1	4	0	3	-36%		
						9	30	0	30		HSC	6	20.0		20	6	21	0	21	5%		
						9	31	0	31		Math	6	20.7		20.7	6	20	0	20	-3%		
						5	15	8	19	4	Physics	3.3	10.0	5.3	12.7	3	9	6	12	-5%		
BA-3411	Leading Project Teams	'3-0-3			7		3	0	3	FALSE	Business						3		3		BUS-2411	Building Inclusive Teams
BA-3423	Innovation and Business Markets			'3-0-3	9		3	0	3	FALSE	Business						3		3		BUS-3420	Innovation and Entrepreneurship
BA-2220	Foundations of Business Economics			'3-0-3	11		3	0	3	FALSE	Business											
CS-1011	Software Development I	'3-2-4			1		3	2	4	TRUE	Engineering CS						3	2	4	CS/SE	CSC-1110	Software Development
CS-1021	Software Development II		'3-2-4		2		3	2	4	TRUE	Engineering CS						3	2	4	CS/SE	CSC-1120	Graphical Software and Data Structures
CS-2852	Data Structures			'3-2-4	3		3	2	4	TRUE	Engineering CS											
SE-2030	Software Engineering Tools and Practices			'2-2-3	4		2	2	3	TRUE	Engineering CS											
CS-3841	Design of Operating Systems	'3-2-4			7		3	2	4	TRUE	Engineering CS						3	2	4	CS/SE EL?	CPE-2600	Systems Programming
CS-3210	Computer Graphics			3-2-4	9		3	2	4	TRUE	Engineering CS											
CE-4961	Networking II			4-0-4	11		4	0	4	FALSE	Engineering CS											
	Elective (Technical)			'3-0-3	11		3	0	3	FALSE	Engineering CS						3	0	3		CSE-4	Program Elective
CS-4920	Information Security			'3-0-3	12		3	0	3	FALSE	Engineering CS						3	2	4	CS/SE EL	CPE-4800	Information Security
CE-1901	Digital Logic I	3-2-4			1		3	2	4	TRUE	Engineering EC						3	2	4		CPE-1500	Digital Logic
CE-1911	Digital Logic II		3-2-4		2		3	2	4	TRUE	Engineering EC											
CE-1921	Computer Architecture			'3-2-4	3		3	2	4	TRUE	Engineering EC						3	2	4		CPE-1510	Computer Architecture and Assembly Language
CE-2801	Embedded Systems I	3-2-4			4		3	2	4	TRUE	Engineering EC						3	2	4		CPE-3610	Embedded Systems
EE-2050	Linear Circuits - Steady State I	3-2-4			4		3	2	4	TRUE	Engineering EC						3	2	4	EE	ELE-2001	Circuits 1
CE-2812	Embedded Systems II		3-2-4		5		3	2	4	TRUE	Engineering EC						3	2	4		CPE-3600	Advanced Embedded Systems
EE-2060	Linear Circuits - Steady State II		3-2-4		5		3	2	4	TRUE	Engineering EC						3	2	4	EE	ELE-2011	Circuits 2
CE-2820	Embedded Systems III			'3-2-4	6		3	2	4	TRUE	Engineering EC											
EE-2070	Linear Circuits - Transients			3-0-3	6		3	0	3	FALSE	Engineering EC											
EE-3032	Signals and Systems	4-0-4			7		4	0	4	FALSE	Engineering EC						3	0	3	EE	ELE-3300	Signals
EE-3221	Digital Signal Processing		'3-2-4		8		3	2	4	TRUE	Engineering EC						2	2	3	EE	ELE-3320	DSP
CE-3101	Digital Electronic Interfacing			3-2-4	9		3	2	4	TRUE	Engineering EC						3	2	4	EE	ELE-3101	Electronics 1
CE-4000	Senior Design Project I	'2-2-3			10		2	2	3	TRUE	Engineering EC						2	2	3		CPE-4901	Senior Design I
CE-4951	Networking I	3-2-4			10		3	2	4	TRUE	Engineering EC						3	2	4		CPE-3300	Networking
	Elective (Technical)	'3-0-3			10		3	0	3	FALSE	Engineering EC						3	0	3		CSE-4	Technical Elective
CE-4010	Senior Design Project II		'2-2-3		11		2	2	3	TRUE	Engineering EC						2	2	3		CPE-4902	Senior Design II
CE-4020	Senior Design Project III			'2-2-3	12		2	2	3	TRUE	Engineering EC											
OR-402	Professional Guidance			1-0-1	8		1	0	1	FALSE	General						1	0	0	CS/SE/...	IDS-2020	Career Development
	Elective (Free)			'3-0-3	8		3	0	3	FALSE	General						3	0	3			Elective (Free)
	Elective (Free)			'3-0-3	12		3	0	3	FALSE	General											
GS-1001	Freshman Studies I	4-0-4			1		4	0	4	FALSE	HSC						3		3		COM-1001	College Writing
GS-1002	Freshman Studies II		4-0-4		2		4	0	4	FALSE	HSC						3		3		COM-2001	STEM Writing
GS-1003	Freshman Studies III			4-0-4	3		4	0	4	FALSE	HSC						3		3		COM-3001	Presentations
HU-432	Ethics for Professional Managers and Engineers			'3-0-3	9		3	0	3	FALSE	HSC						3		3		HSC-4	Elective per GenEd 6d
	Elective (HU/SS)	'3-0-3			10		3	0	3	FALSE	HSC						3		3		HSC-4	Elective per GenEd 6c1
	Elective (HU/SS)	'3-0-3			10		3	0	3	FALSE	HSC						3		3		HSC-4	Elective per GenEd 6c2
	Elective (HU/SS)			'3-0-3	11		3	0	3	FALSE	HSC						3		3		HSC-4	Elective per GenEd 6c3
	Elective (HU/SS)			'3-0-3	12		3	0	3	FALSE	HSC											
	Elective (HU/SS)			'3-0-3	12		3	0	3	FALSE	HSC											
MA-136	Calculus for Engineers I	4-0-4			1		4	0	4	FALSE	Math						4		4		MTH-1110	Calculus I
MA-137	Calculus for Engineers II		4-0-4		2		4	0	4	FALSE	Math						4		4		MTH-1120	Calculus II
MA-2314	Calculus for Engineers III			4-0-4	3		4	0	4	FALSE	Math						0					(Calculus III not required for CE on semesters)
MA-235	Differential Equations for Engineers	4-0-4			4		4	0	4	FALSE	Math						3		3		MTH-2140	Diff Eq + Matrix Algebra
MA-2323	Calculus for Engineers IV			'3-0-3	5		3	0	3	FALSE	Math						3		3		MTH-2480	Probability and stats
MA-262	Probability and Statistics			'3-0-3	6		3	0	3	FALSE	Math											
MA-2310	Discrete Mathematics I	'3-0-3			7		3	0	3	FALSE	Math						3		3		MTH-2310	Discrete Math
MA-383	Linear Algebra		'3-0-3		8		3	0	3	FALSE	Math						3		3		MTH-2340	Linear algebra
	Elective (Math/Science)			'3-0-3	9		3	0	3	FALSE	Math											
PH-2011	Physics I - Mechanics	3-2-4			4		3	2	4	TRUE	Physics						3	2	4		PHY-1110	Physics I - Mechanics and Thermodynamics
PH-2021	Physics II - Electromagnetism and Optics		3-2-4		5		3	2	4	TRUE	Physics						3	2	4		PHY-1120	Physics II - Electricity, Magnetism, and Optics
PH-2031	Physics III - Thermodynamics and Quantum Physics			3-2-4	6		3	2	4	TRUE	Physics											
	Elective (Science)	'3-0-3			7		3	0	3	FALSE	Physics											
PH-3600	Physics of Semiconductor Materials and Devices			3-2-4	8		3	2	4	TRUE	Physics						3	2	4		PHY-3700	Semiconductors
																			21			GenEd Core 21
																			32			GenEd M/S 30

Share

Proposer / Coordinator			Track CE EE Δ	Fall Sections	Students	CE	EE	Spring Sections	Students	CE	EE	Class Size
Meier	CPE 1500	Digital Logic	1 2 1	3	58	50	8	4	76	6	70	20
Meier	CPE 1510	Computer Architecture and Assembly Language	2	0	0			3	56	56		20
Lembke	CPE 2600	Systems Programming	3	3	43	43		0	0			20
Livingston	CPE 2610	Embedded Systems	4	0	0			3	43	43		20
Livingston	CPE 3600	Advanced Embedded Systems	5	2	37	37		0	0			20
Rothe	CPE 3300	Networking	6	0	0			2	37	37		20
Durant	CPE 490x	Senior Design I / II	7-8	2	37	37		2	37	37		20
Durant	CPE 4800	Information Security	8	0	0			2	37	37		20
	CSE 4xxx	Program Elective	7-8 var	2	37	37		2	37	37		20
				12	**212**			**18**	**323**			

Assumptions

Student estimates

	Students	Retention	Fail rates
CE1	50	0.8	0.12
CE2	40	0.9	0.07
CE3	36	1	0.04
CE4	36		0.02
EE1	70	0.8	0.12
EE2	56	0.9	0.07
EE3	50	1	0.04
EE4	50		0.02

Section Size

Lab	20
Lec	27

Prefix #	Course Name	Class Size	Track	Fall Sections	Fall CE	Spring Sections	Spring CE	Category
CSC 1110	SW Dev.	20	1	3	50	0	6	SWE
COM 1001	College Writing	27	1	2	50	0	6	COM
MTH 1110	Calculus I	27	1	2	50	0	6	MTH
CPE 1500	Digital Logic	20	1	3	50	0	6	CPE
CPE 1510	Computer Architecture and Assembly Language	20	2	0	0	3	56	CPE
CSC 1120	DS & Graph	20	2	0	6	3	50	SWE
MTH 1120	Calculus II	27	2	0	6	2	50	MTH
PHY 1110	Physics I	20	2	0	6	3	50	PHY
ELE 2001	Circuits 1	20	3	2	40	0	3	ELE
MTH 2140	Differential Equations and Matrix Alg.	27	3	2	40	0	3	MTH
IDS 2020	Career Development	27	3	2	40	0	3	HSC
PHY 1120	Physics II	20	3	2	40	0	3	PHY
CPE 2840	Systems Programming	20	3	3	43	0		CPE
ELE 2011	Circuits 2	20	4	0	3	2	40	ELE
COM 2001	STEM Writing	27	4	0	3	2	40	COM
HSC 4	(6c GenEd: 3 total)	27	4	0	3	2	40	HSC
MTH 2480	Probability and stats	27	4	0	3	2	40	MTH
CPE 2610	Embedded Systems	20	4	0		3	43	CPE
MTH 2310	Discrete Math	27	5	2	40	0	3	MTH
ELE 3101	Electronics 1	20	5	2	36	0	2	ELE
BUS 2411	Inclusive Teams	27	5	2	36	0	2	BUS
COM 3001	Presentations	27	5	2	36	0	2	COM
CPE 3300	Networking	20	6	0		2	38	CPE
CPE 3810	Advanced Embedded Systems	20	6	2	38	0		CPE
ELE 3101	Signals & Systems	27	6	0	2	2	36	ELE
BUS 3420	Innovation and Entrepreneurship	27	6	0	2	2	36	BUS
MTH 2340	Linear Algebra	27	6	0	2	2	36	MTH
HSC 4	(6c GenEd: 3 total)	27	6	0	2	2	36	HSC
ELE 3320	DSP	20	7	2	36	0	1	ELE
HSC 4	(6c GenEd: 3 total)	27	7	2	36	0	1	HSC
PHY 3700	Semiconductors	20	7	2	36	0	1	PHY
CPE 4800	Information Security	20	8	0	0	2	37	CPE
HSC 4	(6d GenEd)	27	8	0	1	2	36	HSC
CPE 490x	Senior Design I / II	20	7-8	2	37	2	37	CPE
CSE 4xxx	Program Elective	20	7-8	2	37	2	37	CPE
	Free Elective	20	8	0		2	37	Other
				41	**810**	**42**	**823**	

Fall Sections	Fall CE	Spring Sections	Spring CE	Category	Year Totals Sections
12	205	14	254	CPE	26
6	117	4	82	ELE	10
3	56	3	56	SWE	6
21	**378**	**21**	**392**	(EECS)	**42**
2	38	2	38	BUS	4
4	89	2	48	COM	6
4	82	6	116	HSC	10
6	141	6	138	MTH	12
4	82	3	54	PHY	7
0	0	2	37	Other	2
41	**810**	**42**	**823**	Total	**83**

ABET Curriculum and Program Criteria Coverage

Criterion 5 (Curriculum)

The Curriculum criterion for the Engineering Accreditation Commission of ABET requires the following:

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The program curriculum must provide adequate content for each area, consistent with the student outcomes and program educational objectives, to ensure that students are prepared to enter the practice of engineering. The curriculum must include:

- *a. a minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.*
- *b. a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.*
- *c. a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives.*
- *d. a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work.*

The curriculum meets the requirements as follows:

- a. The program has 32 Math/Science credit hours.
- b. The program has 66 Engineering credit hours.
- c. The broad education component complements the technical content and is consistent with the PEOs.
- d. The two-semester senior design project meets the requirements described above.

Program Criteria

The Computer Engineering program criteria for ABET requires:

The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.

The curriculum must include probability and statistics, including applications appropriate to the program name; mathematics through differential and integral calculus; sciences (defined as biological, chemical,

or physical science); and engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.

The curriculum for programs containing the modifier "computer" in the title must include discrete mathematics.

Breaking this down, the topics listed are covered in the following courses:

- probability and statistics, including applications appropriate to the program name
  - MTH2480
  - CPE1510 Computer Architecture and Assembly Language
  - CPE3300 Networking
- mathematics through differential and integral calculus
  - 6 required math. classes covering these topics and more
- sciences (defined as biological, chemical, or physical science); and engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components
  - a year of college physics
  - PH3700 Semiconductor Physics
- discrete mathematics: MTH2310

ABET Student Outcome Assessment

The program makes use of several targeted assessments to assess and evaluate the extent to which student attain the seven student outcomes.

Breakdown By Outcome

- SO1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
  - CPE2600 (fall) – TBD
  - CPE2610 (spring) – final exam problem TBD
- SO2 an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
  - CPE4902 (spring) – evaluate design artifacts in final senior design report, tie back to original requirements and specifications – this should be significant as it is the only targeted assessment for this outcome
- SO3 an ability to communicate effectively with a range of audiences
  - CPE3300 (spring) – written, evaluate formal lab report
  - CPE4901 (fall) – oral, senior design presentations
- SO4 an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic,
  environmental, and societal contexts
  - CPE4800 (spring) – exam question about a data breach case study – identify what malpractices led to the breach
  - CPE4901 (fall) – evaluate project proposal, requirements, and specifications
- SO5 an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
  - CPE3300 (spring) – instructor evaluation
  - CPE4901 (fall) – instructor evaluation
- SO6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
  - CPE4902 (spring) – test plan evaluation, results analysis
  - CPE3600 (fall) – test plan evaluation, results analysis
- SO7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

- CPE3600 (fall) – evaluate implementation of previously unknown subsystem
- CPE4902 (spring) – instructor evaluation of team performance through iterative development sprints

Breakdown By Course

Fall

- CPE2600 – SO1
- CPE3600 – SO6, SO7
- CPE4901 – SO3, SO5

Spring

- CPE2610 – SO1
- CPE3300 – SO3, SO5
- CPE4902 – SO2, SO4, SO6, SO7
- CPE4800 – SO4

Robustness and Alternate Pathways

Robustness to Delays

Not passing CPE2600 in S3 moves CPE2610 to S6, which moves CPE3300 to S8. Not passing CPE2610 in S4 also moves CPE3300 to S8.

The curriculum is reasonably robust to mathematics delays. Students for whom precalculus is recommended will continue to receive credit for the free elective. The curriculum can handle a 1-semester delay in mathematics (from precalculus being required or from failing one class). A 2-semester delay causes ELE2011 to be delayed 1 semester. The ELE courses will be offered every semester, reducing many delays to only 1 semester. However, if a student delays MTH2480 for 2 semesters, it moves CPE3300 to S8.

Significant AP or Transfer Credit

For students who enter with sufficient AP or transfer credit in mathematics, the sciences, and arts and letters, 3-year plans remain viable. Critical paths:

- CSC1110 S1; CPE2600 S3; CPE2610 S4; CPE3600 S5; CPE3300/4800 S6
- ELE2001 S1; ELE2011 S2; ELE3101/3300 S3; ELE3320 S4

Thus, the first software development course remains a critical prerequisite for accelerated students.

EEX

Analysis of keeping the EEX pathway to CE is ongoing. It it will require 2.5 years at MSOE in most cases. Three years will be required for students who have no or virtually no programming experience.

After completing the EEX digital/programming bridge course, students would:

- Still need to take CSC-1110 Software Development at MSOE if they did not also transfer it in, perhaps via an "in lieu" course at their first institution
- Not need to take CPE-1500 Digital the shared CE/EE digital logic course since it would be covered by the digital/programming bridge course
- Still need to take CPE-2600 Systems Programming.

In many cases students will have had a C course with sufficient material to start in CPE-2600 their first term (even if they don't have a CSC-1110 equivalent), taking it in parallel with the digital

logic/programming bridge course. They could then take CPE-2610 in S2, CPE-3600 in S3 and CPE-3300 in S4.

If a student had neither CSC-1110 credit or a sufficient introductory programming course, in S1 at MSOE they would take the digital logic/programming bridge course and CSC-1110. Then, in S3 they would take CPE-2600 (fall only) Systems Programming, moving on to CPE-2610 Embedded in S4. This means CPE-3600 Advanced Embedded Systems (fall only) would be in S5 and CPE-3300 Networking (spring only) would be in S6.

Czech Exchange

Spring of the second or third year remains viable for participating in the Czech exchange, with spring of the third year being preferred purely from a curriculum point of view. CAECM confirms that they will continue to send students in spring (sophomore year), which will allow us to continue to coordinate many aspects of the program across CAECM and EECS.

- Students usually take courses that transfer back as 1 or 2 semester courses in signals, DSP, or networking, aligning well with the third year CE curriculum.
- Students are required to take courses in Czech Language and Czech Culture, which meet a humanities and a social science selected elective on the quarter system.
  - HSC anticipates that Czech Language will fulfil a 6c requirement for "Exhibit Curiosity"
  - It is not yet known if Czech Culture will fulfil a 6c or 6d requirement.

CLO Coverage Plan

The MSOE document "General Education Considerations and Credit Distributions" the my.msoe.edu semester conversion portal (undated, downloaded 2021-09-20) states as its final point, "7. The academic programs shall provide learning experiences that address and assess all Common Learning Outcomes. Unless otherwise approved, these assessments are administered in courses offered by the academic programs. The programs may use the common assessment tools or utilize program assessments that align with Common Learning Outcomes."

The CE program assesses these CLOs addressed in various ways:

- Through a required class in another department developed in collaboration with that department
- Through mapping from Student Outcomes that are assessed as part of our ABET assessment. (SOn)
- Using a customized AAC&U VALUE rubric as recommended by the MSOE General Education Committee, perhaps with program-specific modifications. (CLOn)

Specifically, for the 7 CLOs:

1. Communicate Effectively: Articulate and explain complex ideas clearly across a range of media and audiences
   - CPE4901 – SO3. an ability to communicate effectively with a range of audiences
2. Collaborate Successfully: Work constructively with others towards a common goal
   - BUS2411 Building Inclusive Teams
3. Integrate Learning: Synthesize and transfer learning across new contexts to address complex problems
   - CPE3600 – SO6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
   - CPE4902 – SO2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
4. Demonstrate Ethical Understanding: Engage in independent ethical inquiry on pressing ethical challenges and foster ethical behavior in personal and professional life
   - CPE4902 – SO4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Think Critically: Apply sound principles of critical or analytical reasoning and evaluation of evidence
   - CPE3600 – CLO5

6. Exhibit Curiosity: Practice open-minded intellectual inquiry, creative exploration, and engagement with different perspectives
   - BUS3420 Innovation and Entrepreneurship
7. Embrace Diversity: Demonstrate inclusivity toward others, pursuing intercultural understanding and exploring ways to address historical or existing barriers to social equity
   - BUS2411 Building Inclusive Teams

We note that when we assess a CLO in the senior project, we have aligned the semester with CS and SE if they also assess that CLO in the senior project. The goal is to have each advisor do one type of assessment, segregating students by major, as always. To support that, many of the more specific CS/SE assessments of the same ABET SO / MSOE CLO could be used by advisors primarily advising students in those majors and would be accepted by the CE program as substitutes for the assessments above.

Distribution Across Courses

- BUS2411 (fall) – CLO2, CLO7
- BUS3420 (spring) – CLO6
- CPE3600 (fall) – CLO3, CLO5
- CPE4901 (fall) – CLO1
- CPE4902 (spring) – CLO3, CLO4

Note (10/28/2021): Dr. Domack confirmed that the courses designated as meeting 6e will automatically be used to assess CLO3. Thus, CE may decide to revise its proposal to move 6e assessment to CPE4902 if we decide to do it in only 1 semester of senior design.

Reference: Accepted and Current as of 10/28/2021

CS

- CSC4901 – CLO1
- CSC4902 – CLO3

EE

- ELE4902 (both semesters, but spring is larger) – CLO3

SE

- SWE4901 – CLO1, CLO5, CLO6

- SWE4902 – CLO3, CLO4

CE General Education Framework Compliance

Point 6 of the General Education Framework defines the General Education program as:

The General Education program shall be represented in every year of the curriculum and consist of 30 credit hours which are distributed as follows:

- *a. 9 credit hours of foundational knowledge in communication (three 3 credit hours courses) to demonstrate an ability to communicate effectively and collaborate successfully. Unless otherwise approved, these courses are offered by the Humanities, Social Science and Communication department.*

- *b. 3 credit hours of foundational knowledge in sciences and mathematics to demonstrate an ability to think critically. Unless otherwise approved, these courses are offered by the Mathematics or Physics & Chemistry departments.*

- *c. 9 credit hours of foundational knowledge in the humanities and social sciences (three 3 credit hour courses, one for each area) to demonstrate an ability to exhibit curiosity, embrace diversity, and demonstrate ethical understanding. At least 6 of these credits must be student-selected electives. Unless otherwise approved, these courses are offered by the Humanities, Social Science and Communication department.*

- *d. 3 credit hours of foundational knowledge in the humanities, sciences, mathematics, social sciences and arts to demonstrate an ability to collaborate successfully, think critically, demonstrate ethical understanding, exhibit curiosity, or embrace diversity. These 3 credits must be a student-selected elective. Unless otherwise approved, these courses are offered by the Humanities, Social Science and Communication, Mathematics, or Physics & Chemistry departments.*

- *e. 6 credit hours of integrated project-based experiential learning to demonstrate an ability to integrate learning. Unless otherwise approved, these courses are offered by the academic programs.*

Here is how the program meets these requirements:

- a. COM1001 (year 1), COM2001 (year 2), and COM3001 (year 3) are required.

- b. MTH2310 Discrete Mathematics (year 3) meets this requirement.

- c. The program requires 9 credit hours of foundational knowledge in the humanities and social sciences (three 3-credit courses) designated as *6cN* on the flowchart. These credits are scheduled in years 2 and 3. The exhibit curiosity, embrace diversity, and demonstrate ethical understanding CLOs must each be addressed and assessed in at least one of these courses.

- d. The program requires a 3-credit general education selected elective designated *6d* on the flowchart in spring of the final year. Students will be able to choose from electives that are designated by MSOE to meet the definition of 6d above.

- e. The program requires 6 credit hours of integrated project-based experiential learning through its two-semester senior design project.

  - CPE4902 will provide 3 of these credits.
  - CPE3600 will provide 3 of these credits. For 3 of the course's 4 credits, "the primary objective of the course [must be] for students to work on the project" (2021-05-10 Integrative Learning Requirements). Thus, at least 38% of the student's grade will be determined by the integrated project.
  - Dr. Domack confirmed on 10/28/2021 that the courses designated as meeting 6e will automatically be used to assess CLO3.

Major GPA Courses

The following courses will be included in the Major GPA calculation: all CPE, CSC, CSE, ELE, and SWE prefixed courses.