1

ELECTRICAL ENGINEERING: MACHINE LEARNING AND DATA SCIENCE, BS

The Machine Learning and Data Science option in Electrical Engineering prepares students for a career in electrical engineering with an emphasis on machine learning and data science. The purpose of this option is to provide guidance and recognition for students pursuing this career path. The option uses 18 of the elective credits within the 120-credit Electrical Engineering BS degree program to focus on the mathematics, tools, and practices associated with machine learning and data science in engineering. Students selecting this option must submit an option declaration form to the dean's office in Engineering Hall.

REQUIREMENTS

REQUIREMENTS MACHINE LEARNING AND DATA SCIENCE REQUIRED COURSES

Code	Title	Credits
E C E 204	Data Science & Engineering ¹	3
E C E 331	Introduction to Random Signal Analysis and Statistics (typically offered fall) ²	3
Choose one:		3
MATH 320	Linear Algebra and Differential Equations ³	
MATH 340	Elementary Matrix and Linear Algebra ³	
MATH 341	Linear Algebra ³	
E C E/COMP SCI/ M E 532	Matrix Methods in Machine Learning 4	3
E C E/COMP SCI/ I SY E 524	Introduction to Optimization	3
Total Credits		15

¹ This course can be taken as a Professional Elective.

² This course fulfills the Probability requirement.

- ³ This course can be taken as a Professional Elective and meets the advanced math auxiliary condition. MATH 375 Topics in Multi-Variable Calculus and Linear Algebra and MATH 376 Topics in Multi-Variable Calculus and Differential Equations taken in sequence will fulfill the requirement for MATH 340 Elementary Matrix and Linear Algebra.
- ⁴ This course can be taken as an Advanced Elective and meets the advanced math auxiliary condition.

MACHINE LEARNING AND DATA SCIENCE ELECTIVE

С	ode	Title	Credits
С	hoose one as an Adv	vanced or Professional Elective:	3-4
	E C E 431	Digital Signal Processing (typically offered fall)	
	E C E/ COMP SCI 533	Image Processing (typically offered fall)	
	E C E/COMP SCI/ M E 539	Introduction to Artificial Neural Networks	
	E C E/ COMP SCI 561	Probability and Information Theory in Machine Learning (typically offered fall)	
	ECE/ISYE 570	Ethics of Data for Engineers	
	COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	
	COMP SCI 540	Introduction to Artificial Intelligence	
	COMP SCI 564	Database Management Systems: Design and Implementation ¹	
	COMP SCI/ B M I 567	Medical Image Analysis ¹	
	COMP SCI/ B M I 576	Introduction to Bioinformatics	
	COMP SCI 577	Introduction to Algorithms ¹	
	I SY E 412	Fundamentals of Industrial Data Analytics	
	I SY E 521	Machine Learning in Action for Industrial Engineers	
	L I S 461	Data and Algorithms: Ethics and Policy	
	MATH/I SY E/ OTM/STAT 632	Introduction to Stochastic Processes ¹	
	MATH 635	An Introduction to Brownian Motion and Stochastic Calculus ¹	
	M S & E 460	Introduction to Computational Materials Science and Engineering ¹	
	STAT 421	Applied Categorical Data Analysis ¹	
	STAT/M E 424	Statistical Experimental Design ¹	
	STAT 456	Applied Multivariate Analysis ¹	
	STAT 461	Financial Statistics ¹	

¹ This course has additional requisites not required for the BS in Electrical Engineering.

FOUR-YEAR PLAN

FOUR-YEAR PLAN SAMPLE FOUR-YEAR PLAN

First Year		
Fall	Credits Spring	Credits
MATH 221	5 PHYSICS 201	5
CHEM 103	4 MATH 222	4
E C E 210	2 Communications A or Liberal Studies Elective	3

14 15 Second Year Fall Credits Spring Credits PHYSICS 202 5 E C E 222 4 MATH 234 4 E C E 230 4 E C E 203 3 E C E 270 1 E C E 204 3 E C E 330 3 Free Elective 1 Liberal Studies Elective 3 16 15 Third Year Fall Credits Spring Credits COMP SCI 300 3 EC E Advanced Elective 3 E C E 331 3 E C E/PHYSICS 235 3 E C E 370 3 EE Advanced Lab (3XX) 1 E C E /COMP SCI 352 3 Liberal Studies Elective 3 13 16 16 Fourth Year Fall Credits Spring Credits S C E /COMP SCI 352 3 Liberal Studies Elective 3 13 16 16 Fourth Year Fall Credits Spring Credits E C E/COMP SCI/ 3 ECE Advanced Elective 3 ISY E 524	Liberal Studies Elective or Communications A	3 E C E/COMP SCI 252	3
Fail Credits Spring Credits PHYSICS 202 5 E C E 222 4 MATH 234 4 E C E 230 4 E C E 203 3 E C E 270 1 E C E 204 3 E C E 330 3 Free Elective 1 Liberal Studies Elective 3 Third Year Fall Credits Spring Credits COMP SCI 300 3 ECE Advanced Elective 3 E C E 331 3 E C E /PHYSICS 235 3 E C E 340 3 EE Advanced Lab (3XX) 1 E C E 271 1 INTEREGR 397 3 E C E /COMP SCI 352 3 Liberal Studies Elective 3 MATH 320 3 16 Fourth Year Fall Credits Spring Credits Fourth Year Fall Credits Spring Credits Fourth Year Fall Credits Spring Credits Fall Credits Spring Credits 3 E C E /COMP SCI/ 3 ECE Advanced Elective 3 3 I SY E 524 (4		14	15
PHYSICS 2025 E C E 2224MATH 2344 E C E 2304E C E 2033 E C E 2701E C E 2043 E C E 3303Free Elective1 Liberal Studies Elective3 16 15Third YearFallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 320316Fourth YearFallCredits SpringCreditsFourth Year316Fourth Year32 ECE Advanced Elective3ISY E 524(4XX)23E C E 3702 ECE Advanced Elective33ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ A M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11	Second Year		
MATH 234 4 E C E 230 4 E C E 203 3 E C E 270 1 E C E 204 3 E C E 330 3 Free Elective 1 Liberal Studies Elective 3 Third Year Fall Credits Spring Credits COMP SCI 300 3 EC E Advanced Elective 3 E C E 331 3 E C E/PHYSICS 235 3 E C E 340 3 EE Advanced Lab (3XX) 1 E C E 271 1 INTEREGR 397 3 E C E/COMP SCI 352 3 Liberal Studies Elective 3 Tordits Spring Credits Fall Credits Spring Credits Fourth Year Fall Credits Spring Credits Fourth Year Fall Credits Spring Credits Credits Spring Credits E C E/COMP SCI/ 3 ECE Advanced Elective 3 S C E 370 2 ECE Advanced Elective 3 Credits Spring Credits	Fall	Credits Spring	Credits
E C E 2033 E C E 2701E C E 2043 E C E 3303Free Elective1 Liberal Studies Elective3Third Year1615FallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3TailCredits SpringCreditsFallCredits SpringCreditsFourth Year1316Fourth Year1316Fourth SCI3 ECE Advanced Elective3I S C E 3702 ECE Advanced Elective3I S C E 3702 ECE Advanced Elective3I S C E 3702 ECE Advanced Elective3ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ 33ECE Advanced Elective3 Liberal Studies Elective3ECE Advanced Elective3 Liberal Studies Elective3ECE Advanced Lab (3XX)11	PHYSICS 202	5 E C E 222	4
E C E 2043 E C E 3303Free Elective1 Liberal Studies Elective3Ife15Third YearFallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 3203CreditsFallCredits SpringCreditsFourth YearFallCredits SpringCreditsFallCredits SpringCreditsS C E 2702 ECE Advanced Elective3I SY E 524(4XX)23E C E 3702 ECE Advanced Elective3Data Science Elective33Data Science Elective33ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11	MATH 234	4 E C E 230	4
Free Elective1 Liberal Studies Elective31615Third YearFallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 320316Fourth YearFallCredits SpringCreditsF C E/COMP SCI/3 ECE Advanced Elective3I SY E 524(4XX)23E C E 3702 ECE Advanced Elective3I SY E 524(4XX)33ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ 33ECE Advanced Elective3 Liberal Studies Elective3ECE Advanced Elective3 Liberal Studies Elective3ECE Advanced Lab (3XX)11	E C E 203	3 E C E 270	1
16 15 Third Year Credits Spring Credits Fall Credits Spring Credits COMP SCI 300 3 ECE Advanced Elective 3 E C E 331 3 E C E/PHYSICS 235 3 E C E 340 3 EE Advanced Lab (3XX) 1 E C E 271 1 INTEREGR 397 3 E C E/COMP SCI 352 3 Liberal Studies Elective 3 MATH 320 3 16 Fourth Year Fall Credits Spring Credits Fourth Year 1 16 Fall Credits Spring Credits E C E/COMP SCI/ 3 ECE Advanced Elective 3 I SY E 524 (4XX) 1 E C E 370 2 ECE Advanced Elective 3 I SY E 524 3 Machine Learning and Data Science Elective 3 ECE Advanced Elective 3 Machine Learning and Data Science Elective 3 ECE Advanced Elective 4 E C E/COMP SCI/ M E 532 3 3 Liberal Studies Elective 3 Liberal Studies Elective 3 <td>E C E 204</td> <td>3 E C E 330</td> <td>3</td>	E C E 204	3 E C E 330	3
Third YearFallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 320316Fourth YearFallCredits SpringCreditsE C E/COMP SCI/ 1SY E 5243 ECE Advanced Elective3ISY E 524(4XX)3EC E Advanced Elective33EC E Advanced Elective33ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3ECE Advanced Lab (3XX)11	Free Elective	1 Liberal Studies Elective	3
FallCredits SpringCreditsCOMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 320316Fourth YearFallCredits SpringCreditsE C E/COMP SCI/ 133 ECE Advanced Elective3I SY E 524(4XX)2E C E 3702 ECE Advanced Elective (4XX)3E CE Advanced Elective3 Machine Learning and Data Science Elective3E CE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3E Advanced Lab (3XX)11		16	15
COMP SCI 3003 ECE Advanced Elective3E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 320316Fourth YearFallCredits SpringCreditsE C E/COMP SCI/ SCI/3 ECE Advanced Elective3I SY E 524(4XX)23E C E 3702 ECE Advanced Elective (4XX)3E CE Advanced Elective3 Machine Learning and Data Science Elective3E CE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3E E Advanced Lab (3XX)11	Third Year		
E C E 3313 E C E/PHYSICS 2353E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 3203TallCredits SpringCreditsFallCredits SpringCreditsE C E/COMP SCI/ SCI/3 ECE Advanced Elective3I SY E 524(4XX)3E C E 3702 ECE Advanced Elective3(4XX)3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11	Fall	Credits Spring	Credits
E C E 3403 EE Advanced Lab (3XX)1E C E 2711 INTEREGR 3973E C E/COMP SCI 3523 Liberal Studies Elective3MATH 3203 Fourth YearFallCredits SpringCredits E C E/COMP SCI/ SCI/ ISY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3E CE Advanced Elective Data Science Elective3ECE Advanced Elective Data Science Elective3ECE Advanced Elective Data Science Elective3ECE Advanced Elective M E 5323Liberal Studies Elective Lab (3XX)1	COMP SCI 300	3 ECE Advanced Elective	3
E C E 271 1 INTEREGR 397 3 E C E/COMP SCI 352 3 Liberal Studies Elective 3 MATH 320 3 13 16 Fourth Year Fall Credits Spring Credits E C E/COMP SCI/ 3 ECE Advanced Elective 3 I SY E 524 (4XX) E C E 370 2 ECE Advanced Elective 3 (4XX) E C E 370 2 ECE Advanced Elective 3 (4XX) E C E Advanced Elective 3 Data Science Elective ECE Advanced Elective 4 E C E/COMP SCI/ 3 M E 532 Liberal Studies Elective 3 Liberal Studies Elective 3 EE Advanced Lab (3XX) 1	E C E 331	3 E C E/PHYSICS 235	3
E C E/COMP SCI 3523 Liberal Studies Elective3MATH 32031316Fourth YearFallCredits SpringCreditsE C E/COMP SCI/ I SY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3E C E Advanced Elective Data Science Elective3E C E Advanced Elective D A Data Science Elective3E Advanced Lab (3XX)1	E C E 340	3 EE Advanced Lab (3XX)	1
MATH 32031316Fourth YearCredits SpringCreditsFallCredits SpringCreditsE C E/COMP SCI/ I SY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3ECE Advanced Elective (4XX)3 Machine Learning and Data Science Elective3ECE Advanced Elective Liberal Studies Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11	E C E 271	1 INTEREGR 397	3
1316Fourth YearFallCredits SpringCreditsE C E/COMP SCI/3 ECE Advanced Elective3I SY E 524(4XX)3E C E 3702 ECE Advanced Elective3(4XX)3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11	E C E/COMP SCI 352	3 Liberal Studies Elective	3
Fourth YearFallCredits SpringCreditsE C E/COMP SCI/ I SY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3E C E Advanced Elective3 Machine Learning and Data Science Elective3E C E Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3E E Advanced Lab (3XX)11		MATH 320	3
FallCredits SpringCreditsE C E/COMP SCI/ I SY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3ECE Advanced Elective (4XX)3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11		13	16
E C E/COMP SCI/ I SY E 5243 ECE Advanced Elective (4XX)3E C E 3702 ECE Advanced Elective (4XX)3ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)1	Fourth Year		
I SY E 524(4XX)E C E 3702 ECE Advanced Elective (4XX)3ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)1	Fall	Credits Spring	Credits
(4XX)ECE Advanced Elective3 Machine Learning and Data Science Elective3ECE Advanced Elective4 E C E/COMP SCI/ M E 5323Liberal Studies Elective3 Liberal Studies Elective3EE Advanced Lab (3XX)11			3
ECE Advanced Elective 4 E C E/COMP SCI/ 3 M E 532 3 Liberal Studies Elective 3 EE Advanced Lab (3XX) 1	E C E 370		3
M E 532 Liberal Studies Elective 3 Liberal Studies Elective 3 EE Advanced Lab (3XX) 1	ECE Advanced Elective	5	3
EE Advanced Lab (3XX) 1	ECE Advanced Elective		3
	Liberal Studies Elective	3 Liberal Studies Elective	3
16 15	EE Advanced Lab (3XX)	1	
		16	15

Total Credits 120