MASTER OF SCIENCE IN ELECTRICAL ENGINEERING WITH SPECIALIZATION IN ENERGY/ENVIRONMENT/ECONOMICS (E3)

Curriculum

Requirement	Credits
Minimum Credits Required	32
Maximum 400-Level Credit	12
Minimum 500-Level Credit	18
Maximum 700-Level Credit	6
Maximum Transfer Credit	9

Code	Title	Credit Hours
E3 Courses		**(12)**
CHE 543	Energy, Environment, and Economics	3
Select a minimum of two courses from Group A		6
Select a minimum of one course from Group B		3
Power & Control Courses		**(6-8)**
Select a minimum of two courses from the following:		6-8
ECE 411	Power Electronics	4
ECE 412	Hybrid Electric Vehicle Drives	4
or ECE 512	Hybrid Electric Vehicle Drives	
ECE 417	Power Distribution Engineering	3
ECE 418	Power System Analysis	3
or ECE 419	Power Systems Analysis with Laboratory	
ECE 420	Analytical Methods for Power System Economics and Cybersecurity	3
ECE 438	Control Systems	3
ECE 505	Applied Optimization for Engineers	3
ECE 506	Analysis of Nonlinear Systems	3
ECE 531	Linear System Theory	3
ECE 533	Robust Control	3
ECE 535	Discrete Time Systems	3
ECE 537	Optimal Feedback Control	3
ECE 538	Renewable Energies	3
ECE 539	Computer Aided Design of Electric Machines	3
ECE 540	Reliability Theory and System Implementation	3
ECE 548	Energy Harvesting	3
ECE 549	Motion Control Systems Dynamics	3
ECE 550	Power Electronic Dynamics and Control	3
ECE 551	Advanced Power Electronics	3
ECE 552	Adjustable Speed Drives	3
ECE 553	Power System Planning	3
ECE 554	Power System Relaying	3
ECE 555	Power Market Operations	3
ECE 556	Power Market Economics and Security	3
ECE 557	Fault-Tolerant Power Systems	3
ECE 558	Power System Reliability	3
ECE 559	High Voltage Power Transmission	3
ECE 560	Power Systems Dynamics and Stability	3
ECE 561	Deregulated Power Systems	3
ECE 562	Power System Transaction Management	3
ECE 563	Artificial Intelligence in Smart Grid	3
ECE 564	Control and Operation of Electric Power Systems	3
ECE 579	Operations and Planning and Distributed Power Grid	3
ECE 580	Elements of Sustainable Energy	3
ECE 581	Elements of Smart Grid	3
ECE 582	Microgrid Design and Operation	3
Communications & Signal Processing		**(3-4)**
Select a minimum of one course from the following:		3-4
ECE 401	Communication Electronics	3
ECE 403	Digital and Data Communication Systems	3-4
or ECE 405	Digital and Data Communication Systems with Laboratory	
ECE 406	Wireless Communications Systems	3
or ECE 504	Wireless Communication System Design	
ECE 421	Microwave Circuits and Systems	3-4
or ECE 423	Microwave Circuits and Systems with Laboratory	
ECE 437	Digital Signal Processing I	3-4
or ECE 436	Digital Signal Processing I with Laboratory	
ECE 481	Image Processing	3
ECE 505	Applied Optimization for Engineers	3
ECE 507	Imaging Theory & Applications	3
ECE 508	Video Communications	3
ECE 509	Electromagnetic Field Theory	3
ECE 511	Analysis of Random Signals	3
ECE 513	Communication Engineering Fundamentals	3
ECE 514	Digital Communication Principles	3
ECE 515	Modern Digital Communications	3
ECE 516	Coding for Distributed Storage Systems	3
ECE 519	Coding for Reliable Communications	3
ECE 520	Information Theory and Applications	3
ECE 522	Electromagnetic Compatibility	3

ECE 565	Computer Vision and Image Processing	3
ECE 566	Machine and Deep Learning	3
ECE 567	Statistical Signal Processing	3
ECE 568	Digital Speech Processing	3
ECE 569	Digital Signal Processing II	3
ECE 570	Fiber-Optic Communication Systems	3
ECE 576	Antenna Theory	3
ECE 578	Microwave Theory	3
Computer & Microelectronics		**(3-4)**
Select a minimum of one course from the following:		3-4
ECE 408	Introduction to Computer Networks	3-4
or ECE 407	Introduction to Computer Networks with Laboratory	
ECE 425	Analysis and Design of Integrated Circuits	3
ECE 429	Introduction to VLSI Design	4
ECE 430	Fundamentals of Semiconductor Devices	3
or ECE 523	Fundamentals of Semiconductor Devices	
ECE 441	Smart and Connected Embedded System Design	4
ECE 442	Internet of Things and Cyber Physical Systems	3
or ECE 510	Internet of Things and Cyber Physical Systems	
ECE 443	Introduction to Computer Cyber Security	3
or ECE 518	Computer Cyber Security	
ECE 444	Computer Network Security	3
or ECE 543	Computer Network Security	
ECE 446	Advanced Logic Design	4
ECE 447	Artificial Intelligence and Edge Computing	3
or ECE 501	Artificial Intelligence and Edge Computing	
ECE 448	Application Software Design	3
or ECE 528	Application Software Design	
ECE 449	Object-Oriented Programming and Machine Learning	3
or ECE 590	Object-Oriented Programming and Machine Learning	
ECE 485	Computer Organization and Design	3
or ECE 585	Computer Organization and Design	
ECE 502	Basic Network Theory	3
ECE 503	5G Wireless Network: Architecture, New Radio, and Security	3
ECE 517	Modern Wireless Network Protocols and Standards	3
ECE 521	Quantum Electronics	3
ECE 524	Advanced Electronic Circuit Design	3
ECE 525	RF Integrated Circuit Design	3
ECE 526	Active Filter Design	3
ECE 527	Performance Analysis of RF Integrated Circuits	3
ECE 529	Advanced VLSI Systems Design	3
ECE 530	High Performance VLSI IC Systems	3
ECE 541	Communications Networks Performance Analysis	3
ECE 542	Design and Optimization of Computer Networks	3
ECE 544	Wireless and Mobile Networks	3
ECE 545	Modern Internet Technologies	3
ECE 546	Wireless Network Security	3
ECE 547		3
ECE 571	Nanodevices and Technology	3
ECE 575	Electron Devices	3
ECE 583	High Speed Computer Arithmetic	3
ECE 584	VLSI Architecture for Signal Processing and Communication Systems	3
ECE 586	Hardware Security and Advanced Computer Architectures	3
ECE 587	Hardware/Software Codesign	3
ECE 588	Hardware Acceleration for Machine Learning	3
ECE 589	Computer-Aided Design of Analog IC	3
Master's Thesis Research		**(6-8)**
ECE 591	Research and Thesis for Masters Degree [1]	6-8
General Electives		**(0-2)**
Select zero to two credit hours of ECE 400-599, ECE 600-699, and ECE 700-799 [2]		0-2

[1] Thesis research topic must be in an interdisciplinary E3 area.
[2] Students should choose one advanced math course if that requirement was not met in the B.S. degree.

E3 Courses

See descriptions under the respective department's course listings.

Group A

CHE 536	Computational Techniques in Engineering	3
CHE 541	Renewable Energy Technologies	3
CHE 542	Fluidization and Gas-Solids Flow Systems	3
CHE 565	Fundamentals of Electrochemistry	3
ECE 550	Power Electronic Dynamics and Control	3
ECE 551	Advanced Power Electronics	3

ECE 552	Adjustable Speed Drives	3
ECE 553	Power System Planning	3
ECE 554	Power System Relaying	3
ECE 555	Power Market Operations	3
ECE 557	Fault-Tolerant Power Systems	3
ECE 558	Power System Reliability	3
ECE 559	High Voltage Power Transmission	3
ECE 560	Power Systems Dynamics and Stability	3
ECE 561	Deregulated Power Systems	3
ECE 562	Power System Transaction Management	3
ECE 563	Artificial Intelligence in Smart Grid	3
ECE 564	Control and Operation of Electric Power Systems	3
MMAE 517	Computational Fluid Dynamics	3
MMAE 520	Advanced Thermodynamics	3
MMAE 522	Nuclear, Fossil-Fuel, and Sustainable Energy Systems	3
MMAE 523	Fundamentals of Power Generation	3
MMAE 524	Fundamentals of Combustion	3
MMAE 525	Fundamentals of Heat Transfer	3
MMAE 526	Conduction and Diffusion	3
MMAE 527	Heat Transfer: Convection and Radiation	3

Group B

CHE 541	Renewable Energy Technologies	3
CHE 560	Statistical Quality and Process Control	3
ENVE 501	Environmental Chemistry	3
ENVE 506	Chemodynamics	3
ENVE 542	Physicochemical Processes in Environmental Engineering	3
ENVE 551	Industrial Waste Treatment	3
ENVE 561	Design of Environmental Engineering Processes	3
ENVE 570	Air Pollution Meteorology	3
ENVE 577	Design of Air Pollution Control Devices	3
ENVE 578	Physical and Chemical Processes for Industrial Gas Cleaning	3
ENVE 580	Hazardous Waste Engineering	3