

# 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
<b>E3 Courses</b> (12)		
CHE 543	Energy Envir Economics	3
Select a minimum of two courses from Group A		
Select a minimum of one course from Group B		
<b>Power &amp; Control Courses</b> (6-8)		
Select a minimum of two courses from the following:		
ECE 411	Power Electronics	4
ECE 412	Hybrid Electric Vehicle Drives	4
ECE 417	Power Dist Engrng	3
ECE 419	Power Systems Analysis w/Lab	4
ECE 420	Analyt. Methods for Power Syst	3
ECE 438	Control Systems	3
ECE 505	Applied Optimization Engrgs	3
ECE 506	Anlyns Nonlinear Systems	3
ECE 531	Linear System Theory	3
ECE 533	Robust Control	3
ECE 535	Discrete Time Systems	3
ECE 538	Renewable Energies	3
ECE 539	Cmpt Aided Dsgn Elec Machines	3
ECE 540	Relibly Theory Syst Implntn	3
ECE 548	Energy Harvesting	3
ECE 549	Motion Control Syst Dynamics	3
ECE 550	Power Elect Dymcs Control	3
ECE 551	Advanced Power Electronics	3
ECE 552	Adjustable Speed Drives	3
ECE 553	Power System Planning	3
ECE 554	Power Systems Relaying	3
ECE 555	Power Market Operations	3
ECE 556	Power Mkt Ecnmcs Security	3
ECE 557	Fault Tolerant Power Systems	3
ECE 558	Power System Reliability	3
ECE 559	High Voltage Power Trans	3
ECE 560	Power Syst Dynamics Stability	3
ECE 561	Deregulated Power Systems	3
ECE 562	Power Syst Tran Management	3
ECE 563	Comptl Intllgnc Engineering	3

ECE 564	Cntrl Oprtn Elect Power Systs	3
ECE 580	Elements of Sustainable Energy	3
ECE 581	Elements of Smart Grid	3
ECE 582	Microgrid Design and Operation	3
<b>Communications &amp; Signal Processing</b> (3-4)		
Select a minimum of one course from the following:		
ECE 401	Communication Electronics	3
ECE 403	Digital & Data Comm Systems	3
ECE 405	Digital & Data Comm Syst w/Lab	4
ECE 421	Microwave Circuits and Systems	3
ECE 423	Microwave Crct&Systs w/Lab	4
ECE 436	Digital Signal Pcsgr w/Lab	4
ECE 437	Digital Signal Processing I	3
ECE 481	Image Processing	3
ECE 504	Wireless Comm Systm Design	3
ECE 507	Imaging Theory & Applications	3
ECE 508	Video Processing & Comm	3
ECE 509	Electromagnetic Field Theory	3
ECE 511	Analysis Random Signals	3
ECE 513	Commctn Engrg Fundamentals	3
ECE 514	Digital Commctn Principles	3
ECE 515	Modern Digital Communications	3
ECE 516	Coding Distributed Storage Sys	3
ECE 519	Coding Reliable Communications	3
ECE 522	Electromagnetic Compatibility	3
ECE 565	Compt Vision Image Processing	3
ECE 566	Statistical Pattern Rcgntn	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 Syst	3
ECE 576	Antenna Theory	3
ECE 578	Microwave Theory	3
<b>Computer &amp; Microelectronics</b> (3-4)		
Select a minimum of one course from the following:		
ECE 407	Intro Comp Ntwks with Lab	4
ECE 408	Intro to Computer Ntwks	3
ECE 425	Anlyns Dsgn Intgrtd Circuits	3
ECE 429	Intro to VLSI Design	4
ECE 441	Microcomputers/Embedded Comp	4
ECE 443	Intro Computer Cyber Security	4
ECE 446	Advanced Logic Design	4
ECE 449	Obj-Orntd Cmpt Sim	3
ECE 485	Computer Organization & Design	3
ECE 502	Basic Network Theory	3
ECE 521	Quantum Electronics	3

ECE 524	Adv Electronic Circuit Design	3	ECE 584	VLSI Archs Sgnl Prcs Commcnctns	3
ECE 525	RF Integrated Circuit Design	3	ECE 585	Advanced Compt Arch	3
ECE 526	Active Filter Design	3	ECE 586	Fault Detcntn Digital Circuits	3
ECE 527	Perform Anlys RF Intgrtd Crcts	3	ECE 587	Hardware Software Codesign	3
ECE 529	Advncd VLSI Systems Dsgn	3	ECE 588	CAD Techniques VLSI Dsgn	3
ECE 530	High Performnc VLSI/IC Systems	3	ECE 589	CAD of Analog IC	3
ECE 541	Perform Eval Compt Ntwrk	3	<b>Master's Thesis Research</b>		(6-8)
ECE 542	Dsgn Optmztn Compt Ntwrks	3	ECE 591	Research and Thesis M.S. <sup>1</sup>	6-8
ECE 543	Computer Network Security	3	<b>General Electives</b>		(0-2)
ECE 544	Wireless and Mobile Networks	3	Select zero to two credit hours of ECE 400-599, ECE 600-699, and ECE 700-799 <sup>2</sup>		0-2
ECE 545	Advanced Computer Networks	3			
ECE 546	Wireless Network Security	3			
ECE 547	Wireless Ntwrks Perf Analysis	3			
ECE 571	Nanodevices Technology	3			
ECE 575	Electron Devices	3			
ECE 583	High Speed Compt Arithmetic	3			

<sup>1</sup> Thesis research topic must be in an interdisciplinary E3 area.

<sup>2</sup> 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 503	Thermodynamics	3
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	Computational Intelligence in Engineering	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	Physiochemical 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