Electrical and Computer Engineering Major

Degree Type
Bachelor of Science

The normal period of residency at WPI is 16 terms. In addition to WPI requirements applicable to all students, students wishing to receive the major designated "Electrical and Computer Engineering" must satisfy certain distribution requirements. These requirements apply to 10 units of study in the areas of mathematics, basic science, and engineering science and design as follows:

Program Distribution Requirements for the Electrical and Computer Engineering Major

Mathematics and Basic Science (Minimum 12/3 Units)

To succeed in the study of electrical and computer engineering, the necessary foundation far exceeds what can be taught in a few introductory courses. In fact, if you even want to begin to understand what your ECE professors are talking about in lecture, you must begin with a firm basis in mathematics and the natural sciences. Moreover, whether applied to ECE or not, proficiency in mathematics and the sciences is a necessary quality for any educated engineer. Consequently, the ECE major requires a total of 4 units (12 courses) as the "Mathematics and Basic Science" distribution requirement.

The first part of this requirement is sufficient education in mathematics. At least 7 of the 12 required courses must be in this area, including coursework in differential calculus, integral calculus, differential equations, and probability. To see which specific courses fulfill these math requirements, please consult the mathematics course descriptions, and your academic advisor.

The other part of the requirement is coursework in the sciences. A solid understanding of physics is essential to any ECE student, being ultimately necessary for describing the behavior of electricity and magnetism as well as other physical phenomena. Knowledge of chemistry is useful as well, encompassing such topics as atomic and molecular behavior and the chemical properties of materials (such as silicon, which is quite useful in ECE). In recent years, knowledge of biology has also become important to electrical and computer engineers, particularly as biomedical-electrical technologies such as medical imaging continue to advance.

The ECE major requires at least 3 courses in the sciences, 2 of these courses must be in physics, and the remaining course may be in chemistry or biology depending on preference.

Finally, note that the total prescribed mathematics and science courses add up to 3 1/3 units (10 courses). To meet the distribution requirement, you then must take at least 2 more courses in any area of mathematics or science (that is, any other course with the prefix "MA", "PH", "CH", "BB", or "GE").

Mathematics (Minimum 7/3 Units)

Item #	Title	Units
BCB 4004/MA 4603	Statistical Methods in Genetics and Bioinformatics	1/3
CS 2022/MA 2201	Discrete Mathematics	1/3
CS 4032/MA 3257	Numerical Methods for Linear and Nonlinear Systems	1/3
CS 4033/MA 3457	Numerical Methods for Calculus and Differential Equations	1/3
DS 4635/MA 4635	Data Analytics and Statistical Learning	1/3
MA 1020	Calculus I with Preliminary Topics	1/3
MA 1021	Calculus I	1/3
MA 1022	Calculus II	1/3
MA 1023	Calculus III	1/3
MA 1024	Calculus IV	1/3
MA 1033	Theoretical Calculus III	1/3
MA 1034	Theoretical Calculus IV	1/3
MA 1120	Calculus II (Semester Version)	1/3
MA 1801	Denksport	1/12
MA 1971	Bridge to Higher Mathematics	1/3
MA 2051	Ordinary Differential Equations	1/3
MA 2071	Matrices and Linear Algebra I	1/3
MA 2072	Accelerated Matrices and Linear Algebra I	1/3
MA 2073	Matrices and Linear Algebra II	1/3
MA 2210	Mathematical Methods in Decision Making	1/3
MA 2211	Theory of Interest I	1/3
MA 2212	Theory of Interest II	1/3
MA 2251	Vector and Tensor Calculus	1/3
MA 2271	Graph Theory	1/3
MA 2273	Combinatorics	1/3
MA 2431	Mathematical Modeling with Ordinary Differential Equations	1/3
MA 2610	Applied Statistics for the Life Sciences	1/3
MA 2611	Applied Statistics I	1/3
MA 2612	Applied Statistics II	1/3
MA 2621	Probability for Applications	1/3
MA 2631	Probability Theory	1/3
MA 3212	Actuarial Mathematics I	1/3
MA 3213	Actuarial Mathematics II	1/3
MA 3231	Linear Programming	1/3
MA 3233	Discrete Optimization	1/3
MA 3457/CS 4033	Numerical Methods for Calculus and Differential Equations	1/3
MA 3471	Advanced Ordinary Differential Equations	1/3
MA 3475	Calculus of Variations	1/3
MA 3627	Introduction to the Design and Analysis of Experiments	1/3
MA 3631	Mathematical Statistics	1/3
MA 3823	Group Theory	1/3
MA 3825	Rings and Fields	1/3
MA 3831	Principles of Real Analysis I	1/3
MA 3832	Principles of Real Analysis II	1/3
MA 4213	Loss Models I - Risk Theory	1/3
MA 4214	Loss Models II - Survival Models	1/3
MA 4216	Actuarial Seminar	
MA 4222	Top Algorithms in Applied Mathematics	1/3
MA 4235	Mathematical Optimization	1/3
MA 4237	Probabilistic Methods in Operations Research	1/3
MA 4291	Applied Complex Variables	1/3
MA 4411	Numerical Analysis of Differential Equations	1/3

MA 4451	Boundary Value Problems	1/3
MA 4473	Partial Differential Equations	1/3
MA 4631	Probability and Mathematical Statistics I	1/3
MA 4632	Probability and Mathematical Statistics II	1/3
MA 4891	Topics in Mathematics	1/3
MA 4892	Topics in Actuarial Mathematics	1/3
MA 4895	Differential Geometry	1/3

Must include at least 7/3 units of math (prefix MA). Mathematics must include differential and integral calculus, differential equations, and probability.

Physics (Minimum 2/3 Units)

Item #	Title	Units
PH 1110	General Physics—Mechanics	1/3
PH 1111	Principles of Physics—Mechanics	1/3
PH 1120	General Physics—Electricity and Magnetism	1/3
PH 1121	Principles of Physics—Electricity and Magnetism	1/3
PH 1130	Modern Physics	1/3
PH 1140	Oscillations and Waves	1/3
PH 1150	Introductory Physics of Living Systems	1/3
PH 2101	Principles of Thermodynamics	1/3
PH 2201	Intermediate Mechanics I	1/3
PH 2202	Intermediate Mechanics II	1/3
PH 2301	Electromagnetic Fields	1/3
PH 2501	Photonics	1/3
PH 2502	Lasers	1/3
PH 2510	Atomic Force Microscopy	1/3
PH 2520	Introduction to Astrophysics	1/3
PH 2540	Solar Systems	1/3
PH 2550/AE 2550	Atmospheric and Space Environments	1/3
PH 2601	Photonics Laboratory	1/3
PH 2651	Intermediate Physics Laboratory	1/3
PH 3206	Statistical Physics	1/3
PH 3301	Electromagnetic Theory	1/3
PH 3401	Quantum Mechanics I	1/3
PH 3402	Quantum Mechanics II	1/3
PH 3501	Relativity	1/3
PH 3502	Solid State Physics	1/3
PH 3503	Nuclear Physics	1/3
PH 3504	Optics	1/3
PH 4201/PH 511	Advanced Classical Mechanics	1/3

Must include at least 2/3 units of physics (prefix PH).

Chemistry OR Biology (Minimum 1/3 Units)

Item #	Title	Units
BB 1001	Introduction to Biology	1/3
BB 1002	Environmental Biology	1/3
BB 1003/BCB 1003	Exploring Bioinformatics and Computational Biology	1/3
BB 1025	Human Biology	1/3
BB 1035	Biotechnology	1/3
BB 1045	Biodiversity	1/3
BB 2002	Microbiology	1/3
BB 2003	Fundamentals of Microbiology	1/3
BB 2030	Plant Diversity	1/3
BB 2040	Principles of Ecology	1/3
BB 2050	Animal Behavior	1/3
BB 2550	Cell Biology	1/3
BB 2902	Enzymes, Proteins, and Purification	1/6
BB 2903	Anatomy and Physiology	1/6
BB 2904	Ecology, Environment, and Animal Behavior	1/6
BB 2915	Searching for Solutions in Soil: Microbial and Molecular Investigations	1/3
BB 2917	Hunting for Phage	1/3
BB 2920	Genetics	1/3
BB 2950	Molecular Biology	1/3
BB 3003	Medical Microbiology: Plagues of the Modern World, a Case Study Approach	1/3
BB 3010/BCB 3010	Simulation in Biology	1/3
BB 3050	Cancer Biology	1/3
BB 3080	Neurobiology	1/3
BB 3101	Human Anatomy & Physiology: Movement and Communication	1/3
BB 3102	Human Anatomy & Physiology: Transport and Maintenance	1/3
BB 3120	Plant Physiology	1/3
BB 3140	Evolution: Pattern and Process	1/3
BB 3512	Molecular Genetics Lab	1/6
BB 3513	Cell Culture Techniques for Animal Cells	1/6
BB 3515	Physiologic Systems Laboratory	1/3
BB 3517	Fermentation	1/6
BB 3519	Protein Purification	1/6
BB 3521	Microscopy	1/6
BB 3525	Plant Physiology	1/6
BB 3526	Phage Hunters: the Analysis	1/6
BB 3527	Molecular Biology and Genetic Engineering: Approaches and Applications	1/3
BB 3530	Immunotherapies: The Next Generation of Pharmaceuticals	1/3
BB 3570	Cell Culture Models for Tissue Regeneration	1/3
BB 3620	Developmental Biology	1/3
BB 3920	Immunology	1/3
BB 4150	Environmental Change: Problems and Approaches	1/3
BB 4170/CH 4170	Experimental Genetic Engineering	1/3
BB 4190/CH 4190	Regulation of Gene Expression	1/3
BB 4260	Synthetic Biology	1/3
BB 4801/BCB 4001	Bioinformatics	1/3
BB 4900	Capstone Experience in Biology and Biotechnology	1/3
CH 1010	Chemical Properties, Bonding, and Forces	1/3
CH 1020	Chemical Reactions	1/3
CH 1030	Kinetics, Equilibrium and Thermodynamics	1/3

CH 1040	Spectroscopy in Organic and Polymer Chemistry	1/3
CH 2310	Organic Chemistry I	1/3
CH 2320	Organic Chemistry II	1/3
CH 2330	Organic Chemistry III	1/3
CH 2360	Organic Laboratory	1/3
CH 2640	Experimental Chemistry I: Instrumental Analysis	1/3
CH 2650	Modern Physical Chemistry Methods	1/3
CH 2660	Organic Synthesis and Analysis Laboratory	1/3
CH 2670	Investigation of Coordination Complexes Through Inquiry	1/3
CH 3310	Advanced Organic Chemistry	1/3
CH 3410	Structure, Bonding, and Reactivity in Inorganic Chemistry	1/3
CH 3510	Chemical Thermodynamics	1/3
CH 3530	Quantum Chemistry	1/3
CH 3550	Chemical Dynamics	1/3
CH 4110	Protein Structure and Function	1/3
CH 4120	Lipids and Biomembrane Functions	1/3
CH 4130	Nucleic Acids and Bioinformation	1/3
CH 4140	Metabolism and Disease	1/3
CH 4150	Enzymology and Protein Characterization Laboratory	1/3
CH 4160	Membrane Biophysics	1/3
CH 4330	Organic Synthesis	1/3
CH 4420	Principles and Applications of Group Theory in Chemistry	1/3
CH 4520	Chemical Statistical Mechanics	1/3

Must include at least 1/3 units of chemistry (prefix CH) or 1/3 units biology (prefix BB).

Math or Basic Science (Minimum 2/3 Units)

Must include an additional 2/3 units of math or basic science (prefixes MA, PH, CH, BB, or GE).

Item #	Title	Units
BCB 4004/MA 4603	Statistical Methods in Genetics and Bioinformatics	1/3
CS 2022/MA 2201	Discrete Mathematics	1/3
CS 4032/MA 3257	Numerical Methods for Linear and Nonlinear Systems	1/3
CS 4033/MA 3457	Numerical Methods for Calculus and Differential Equations	1/3
DS 4635/MA 4635	Data Analytics and Statistical Learning	1/3
MA 1020	Calculus I with Preliminary Topics	1/3
MA 1021	Calculus I	1/3
MA 1022	Calculus II	1/3
MA 1023	Calculus III	1/3
MA 1024	Calculus IV	1/3
MA 1033	Theoretical Calculus III	1/3
MA 1034	Theoretical Calculus IV	1/3
MA 1120	Calculus II (Semester Version)	1/3
MA 1801	Denksport	1/12
MA 1971	Bridge to Higher Mathematics	1/3
MA 2051	Ordinary Differential Equations	1/3
MA 2071	Matrices and Linear Algebra I	1/3
MA 2072	Accelerated Matrices and Linear Algebra I	1/3
MA 2073	Matrices and Linear Algebra II	1/3
MA 2210	Mathematical Methods in Decision Making	1/3
MA 2211	Theory of Interest I	1/3
MA 2212	Theory of Interest II	1/3
MA 2251	Vector and Tensor Calculus	1/3
MA 2271	Graph Theory	1/3
MA 2273	Combinatorics	1/3
MA 2431	Mathematical Modeling with Ordinary Differential Equations	1/3
MA 2610	Applied Statistics for the Life Sciences	1/3
MA 2611	Applied Statistics I	1/3
MA 2612	Applied Statistics II	1/3
MA 2621	Probability for Applications	1/3
MA 2631	Probability Theory	1/3
MA 3212	Actuarial Mathematics I	1/3
MA 3213	Actuarial Mathematics II	1/3
MA 3231	Linear Programming	1/3
MA 3233	Discrete Optimization	1/3
MA 3457/CS 4033	Numerical Methods for Calculus and Differential Equations	1/3
MA 3471	Advanced Ordinary Differential Equations	1/3
MA 3475	Calculus of Variations	1/3
MA 3627	Introduction to the Design and Analysis of Experiments	1/3
MA 3631	Mathematical Statistics	1/3
MA 3823	Group Theory	1/3
MA 3825	Rings and Fields	1/3
MA 3831	Principles of Real Analysis I	1/3
MA 3832	Principles of Real Analysis II	1/3
MA 4213	Loss Models I - Risk Theory	1/3
MA 4214	Loss Models II - Survival Models	1/3
MA 4216	Actuarial Seminar	
MA 4222	Top Algorithms in Applied Mathematics	1/3
MA 4235	Mathematical Optimization	1/3
MA 4237	Probabilistic Methods in Operations Research	1/3
MA 4291	Applied Complex Variables	1/3
MA 4411	Numerical Analysis of Differential Equations	1/3

MA 4451	Boundary Value Problems	1/3
MA 4473	Partial Differential Equations	1/3
MA 4631	Probability and Mathematical Statistics I	1/3
MA 4632	Probability and Mathematical Statistics II	1/3
MA 4891	Topics in Mathematics	1/3
MA 4892	Topics in Actuarial Mathematics	1/3
MA 4895	Differential Geometry	1/3

Physics (PH) Courses

Item #	Title	Units
PH 1110	General Physics—Mechanics	1/3
PH 1111	Principles of Physics—Mechanics	1/3
PH 1120	General Physics—Electricity and Magnetism	1/3
PH 1121	Principles of Physics—Electricity and Magnetism	1/3
PH 1130	Modern Physics	1/3
PH 1140	Oscillations and Waves	1/3
PH 1150	Introductory Physics of Living Systems	1/3
PH 2101	Principles of Thermodynamics	1/3
PH 2201	Intermediate Mechanics I	1/3
PH 2202	Intermediate Mechanics II	1/3
PH 2301	Electromagnetic Fields	1/3
PH 2501	Photonics	1/3
PH 2502	Lasers	1/3
PH 2510	Atomic Force Microscopy	1/3
PH 2520	Introduction to Astrophysics	1/3
PH 2540	Solar Systems	1/3
PH 2550/AE 2550	Atmospheric and Space Environments	1/3
PH 2601	Photonics Laboratory	1/3
PH 2651	Intermediate Physics Laboratory	1/3
PH 3206	Statistical Physics	1/3
PH 3301	Electromagnetic Theory	1/3
PH 3401	Quantum Mechanics I	1/3
PH 3402	Quantum Mechanics II	1/3
PH 3501	Relativity	1/3
PH 3502	Solid State Physics	1/3
PH 3503	Nuclear Physics	1/3
PH 3504	Optics	1/3
PH 4201/PH 511	Advanced Classical Mechanics	1/3

Item #	Title	Units
BB 4170/CH 4170	Experimental Genetic Engineering	1/3
BB 4190/CH 4190	Regulation of Gene Expression	1/3
CH 1010	Chemical Properties, Bonding, and Forces	1/3
CH 1020	Chemical Reactions	1/3
CH 1030	Kinetics, Equilibrium and Thermodynamics	1/3
CH 1040	Spectroscopy in Organic and Polymer Chemistry	1/3
CH 2310	Organic Chemistry I	1/3
CH 2320	Organic Chemistry II	1/3
CH 2330	Organic Chemistry III	1/3
CH 2360	Organic Laboratory	1/3
CH 2640	Experimental Chemistry I: Instrumental Analysis	1/3
CH 2650	Modern Physical Chemistry Methods	1/3
CH 2660	Organic Synthesis and Analysis Laboratory	1/3
CH 2670	Investigation of Coordination Complexes Through Inquiry	1/3
CH 3310	Advanced Organic Chemistry	1/3
CH 3410	Structure, Bonding, and Reactivity in Inorganic Chemistry	1/3
CH 3510	Chemical Thermodynamics	1/3
CH 3530	Quantum Chemistry	1/3
CH 3550	Chemical Dynamics	1/3
CH 4110	Protein Structure and Function	1/3
CH 4120	Lipids and Biomembrane Functions	1/3
CH 4130	Nucleic Acids and Bioinformation	1/3
CH 4140	Metabolism and Disease	1/3
CH 4150	Enzymology and Protein Characterization Laboratory	1/3
CH 4160	Membrane Biophysics	1/3
CH 4330	Organic Synthesis	1/3
CH 4420	Principles and Applications of Group Theory in Chemistry	1/3
CH 4520	Chemical Statistical Mechanics	1/3

Item #	Title	Units
BB 1001	Introduction to Biology	1/3
BB 1002	Environmental Biology	1/3
BB 1003/BCB 1003	Exploring Bioinformatics and Computational Biology	1/3
BB 1025	Human Biology	1/3
BB 1035	Biotechnology	1/3
BB 1045	Biodiversity	1/3
BB 2002	Microbiology	1/3
BB 2003	Fundamentals of Microbiology	1/3
BB 2030	Plant Diversity	1/3
BB 2040	Principles of Ecology	1/3
BB 2050	Animal Behavior	1/3
BB 2550	Cell Biology	1/3
BB 2902	Enzymes, Proteins, and Purification	1/6
BB 2903	Anatomy and Physiology	1/6
BB 2904	Ecology, Environment, and Animal Behavior	1/6
BB 2915	Searching for Solutions in Soil: Microbial and Molecular Investigations	1/3
BB 2917	Hunting for Phage	1/3
BB 2920	Genetics	1/3
BB 2950	Molecular Biology	1/3
BB 3003	Medical Microbiology: Plagues of the Modern World, a Case Study Approach	1/3
BB 3010/BCB 3010	Simulation in Biology	1/3
BB 3050	Cancer Biology	1/3
BB 3080	Neurobiology	1/3
BB 3101	Human Anatomy & Physiology: Movement and Communication	1/3
BB 3102	Human Anatomy & Physiology: Transport and Maintenance	1/3
BB 3120	Plant Physiology	1/3
BB 3140	Evolution: Pattern and Process	1/3
BB 3512	Molecular Genetics Lab	1/6
BB 3513	Cell Culture Techniques for Animal Cells	1/6
BB 3515	Physiologic Systems Laboratory	1/3
BB 3517	Fermentation	1/6
BB 3519	Protein Purification	1/6
BB 3521	Microscopy	1/6
BB 3525	Plant Physiology	1/6
BB 3526	Phage Hunters: the Analysis	1/6
BB 3527	Molecular Biology and Genetic Engineering: Approaches and Applications	1/3
BB 3530	Immunotherapies: The Next Generation of Pharmaceuticals	1/3
BB 3570	Cell Culture Models for Tissue Regeneration	1/3
BB 3620	Developmental Biology	1/3
BB 3920	Immunology	1/3
BB 4150	Environmental Change: Problems and Approaches	1/3
BB 4170/CH 4170	Experimental Genetic Engineering	1/3
BB 4190/CH 4190	Regulation of Gene Expression	1/3
BB 4260	Synthetic Biology	1/3
BB 4801/BCB 4001	Bioinformatics	1/3
BB 4900	Capstone Experience in Biology and Biotechnology	1/3

Geosciences (GE) Courses

Item #	Title	Units
GE 2341	Geology	1/3

Engineering Science and Design (ES/D) (including the MQP) (Minimum 18/3 Units)

Because modern engineering practice is increasingly interdisciplinary, all students achieve some breadth of study outside of the ECE department by taking a minimum of one Computer Science and two Engineering Science and Design courses. These courses must be at the 2000-level or higher, and certain courses with limited technical content are not credited towards this requirement. (See the formal requirements listed previously in the distribution requirements.) Many students find it advantageous to take more than the minimum CS course requirement. CS 2301 is highly recommended for ECE students.

Electrical and Computer Engineering Area (Minimum 15/3 Units)

Must include at least 5 units at the 2000-level or higher within the Electrical and Computer Engineering area (including the MQP). All courses with prefix ECE at the 2000-level or higher and ES 3011 are applicable to these 5 units.

Must include at least 1 unit of courses from these approved Electrical Engineering courses:

Approved Electrical Engineering Courses

Item #	Title	Units
ECE 2112	Electromagnetic Fields	1/3
ECE 2201	Microelectronic Circuits I	1/3
ECE 2305	Introduction to Communications and Networks	1/3
ECE 2312	Discrete-Time Signal and System Analysis	1/3
ECE 3012	Introduction to Control Systems Engineering	1/3
ECE 3113	Introduction to RF Circuit Design	1/3
ECE 3204	Microelectronic Circuits II	1/3
ECE 3308	Introduction to Wireless Networks	1/3
ECE 3311	Principles of Communication Systems	1/3
ECE 3500	Electric Power and Renewable Energy Systems	1/3
ECE 4305	Software-Defined Radio Systems and Analysis	1/3
ECE 4503	Power Electronics And Power Management	1/3
ECE 4703	Real-Time Digital Signal Processing	1/3
ECE 4902	Analog Integrated Circuit Design	1/3
ECE 4904	Semiconductor Devices	1/3
ES 3011	Control Engineering I	1/3

Must include at least 2/3 unit of courses from these approved Computer Engineering courses:

Approved Computer Engineering Courses

Item #	Title	Units
ECE 2029	Introduction to Digital Circuit Design	1/3
ECE 2049	Embedded Computing in Engineering Design	1/3
ECE 3829	Advanced Digital System Design with FPGAs	1/3
ECE 4801	Computer Organization and Design	1/3

Must include 1/3 unit of Capstone Design Experience. (This requirement is typically fulfilled by the MQP.)

Must include at least 1/3 unit of computer science (prefix CS), at the 2000-level or above (other than CS 2011, CS 2022, CS 3043 which cannot be applied to this requirement).

2000+ Level Computer Science Courses

Item #	Title	Units
BCB 4002/CS 4802	Biovisualization	1/3
BCB 4003/CS 4803	Biological and Biomedical Database Mining	1/3
CS 2011	Introduction to Machine Organization and Assembly Language	1/3
CS 2022/MA 2201	Discrete Mathematics	1/3
CS 2102	Object-Oriented Design Concepts	1/3
CS 2103	Accelerated Object-Oriented Design Concepts	1/3
CS 2119	Application Building with Object-Oriented Concepts	1/3
CS 2223	Algorithms	1/3
CS 2301	Systems Programming for Non-Majors	1/3
CS 2303	Systems Programming Concepts	1/3
CS 3013	Operating Systems	1/3
CS 3041	Human-Computer Interaction	1/3
CS 3043	Social Implications of Information Processing	1/3
CS 3133	Foundations of Computer Science	1/3
CS 3431	Database Systems I	1/3
CS 3516	Computer Networks	1/3
CS 3733	Software Engineering	1/3
CS 4032/MA 3257	Numerical Methods for Linear and Nonlinear Systems	1/3
CS 4033/MA 3457	Numerical Methods for Calculus and Differential Equations	1/3
CS 4099	Special Topics in Computer Science	1/3
CS 4100/IMGD 4100	Artificial Intelligence for Interactive Media and Games	1/3
CS 4120	Analysis of Algorithms	1/3
CS 4123	Theory of Computation	1/3
CS 4233	Object-Oriented Analysis and Design	1/3
CS 4241	Webware: Computational Technology for Network Information Systems	1/3
CS 4300/IMGD 4300	Graphics, Simulation, and Aesthetics	1/3
CS 4341	Introduction to Artificial Intelligence	1/3
CS 4342	Machine Learning	1/3
CS 4401	Software Security Engineering	1/3
CS 4404	Tools and Techniques in Computer Network Security	1/3
CS 4432	Database Systems II	1/3
CS 4433/DS 4433	Big Data Management and Analytics	1/3
CS 4445	Data Mining and Knowledge Discovery in Databases	1/3
CS 4513	Distributed Computing Systems	1/3
CS 4515	Computer Architecture	1/3
CS 4516	Advanced Computer Networks	1/3
CS 4518	Mobile and Ubiquitous Computing	1/3
CS 4533	Techniques of Programming Language Translation	1/3
CS 4536	Programming Languages	1/3
CS 4731	Computer Graphics	1/3
CS 4732	Computer Animation	1/3
CS 4801/ECE 4802	Introduction to Cryptography and Communication Security	1/3
CS 4804	Data Visualization	1/3
MA 3457/CS 4033	Numerical Methods for Calculus and Differential Equations	1/3

Must include an additional 2/3 unit of engineering science and design at the 2000-level or above, selected from courses having the prefix AE, AREN, BME, CE, CHE, CS (other than CS 2011, CS 2022, CS 3043), ECE, ES, FP, ME, or RBE.

2000+ Level Aerospace Engineering (AE) Courses

Item #	Title	Units
AE 2110	Introduction to Incompressible Fluid Dynamics	1/3
AE 2310	Introduction to Aerospace Control Systems	1/3
AE 2320	Introduction to Orbital Mechanics	1/3
AE 2410	Introduction to Aerospace Structures	1/3
AE 3110	Fundamentals of Compressible Fluid Dynamics	1/3
AE 3120	Fundamentals of Aerodynamics	1/3
AE 3310	Fundamentals of Navigation and Communication	1/3
AE 3420	Fundamentals of Aerospace Structures	1/3
AE 3430	Fundamentals of Composite Materials	1/3
AE 4210	Fundamentals of Air-Breathing Propulsion	1/3
AE 4220	Fundamentals of Rocket Propulsion	1/3
AE 4310	Fundamentals of Aircraft Dynamics and Control	1/3
AE 4320	Fundamentals of Spacecraft Dynamics and Control	1/3
AE 4410	Fundamentals of Structural Dynamics	1/3
AE 4510	Aircraft Design	1/3
AE 4520	Spacecraft and Mission Design	1/3
PH 2550/AE 2550	Atmospheric and Space Environments	1/3

2000+ Level Architectural Engineering (AREN) Courses

Item #	Title	Units
AREN 2002	Architectural Design I	1/3
AREN 2004	Architectural Design II - Light and Lighting Systems	1/3
AREN 2023	Introduction to Architectural Engineering Systems	1/3
AREN 2025	Building Electrical Systems	1/3
AREN 3002	Architectural Design III	1/3
AREN 3003	Principles of HVAC Design for Buildings	1/3
AREN 3005	Lighting Systems	1/3
AREN 3006	Advanced HVAC System Design	1/3
AREN 3020	Architectural Design IV - Building Energy Simulation	1/3
AREN 3022	Architectural Design V - Building Envelope Design	1/3
AREN 3024	Building Physics	1/3
AREN 3025	Building Energy Simulation	1/3

Item #	Title	Units
BME 2001	Introduction to Biomaterials	1/3
BME 2210	Biomedical Signals, Instruments and Measurements	1/3
BME 2211	Biomedical Data Analysis	1/3
BME 2502	Introduction to Biomechanics: Stress Analysis	1/3
BME 2610	Introduction to Bioprocess Engineering	1/3
BME 3012	Biomedical Sensors Laboratory	1/6
BME 3013	Biomedical Instrumentation Laboratory	1/6
BME 3014	Physiological Signals Laboratory I: Techniques	1/6
BME 3111	Physiology and Engineering	1/3
BME 3112	Human Physiology for Biomedical Engineers	1/3
BME 3300	Biomedical Engineering Design	1/3
BME 3503	Skeletal Biomechanics Laboratory	1/6
BME 3505	Solid Biomechanics Laboratory: Techniques	1/6
BME 3506	Solid Biomechanics Laboratory: Applications	1/6
BME 3605	Biotransport Laboratory II: Applications	1/6
BME 3610	Transport Analysis in Bioengineering	1/3
BME 3811	Biomaterials Lab	1/6
BME 3813	Cellular Engineering Lab	1/6
BME 4011/ECE 4011	Biomedical Signal Analysis	1/3
BME 4023/ECE 4023	Biomedical Instrumentation Design	1/3
BME 4201	Biomedical Imaging	1/3
BME 4300	MQP Capstone Design	1/6
BME 4503	Computational Biomechanics	1/3
BME 4504/ME 4504	Biomechanics	1/3
BME 4606/ME 4606	Biofluids	1/3
BME 4701	Cell and Molecular Bioengineering	1/3
BME 4814/ME 4814	Biomaterials	1/3
BME 4828	Biomaterials-Tissue Interactions	1/3
BME 4831	Drug Delivery	1/3

2000+ Level Civil, Engineering & Architectural Engineering (CE) Courses

Item #	Title	Units
CE 2000	Analytical Mechanics I	1/3
CE 2001	Analytical Mechanics II	1/3
CE 2002	Introduction to Analysis and Design	1/3
CE 2020	Surveying	1/3
CE 3006	Design of Steel Structures	1/3
CE 3008	Design of Reinforced Concrete Structures	1/3
CE 3010	Structural Engineering	1/3
CE 3020	Project Management	1/3
CE 3022	Legal Aspects of Professional Practice	1/3
CE 3025	Project Evaluation	1/3
CE 3026	Materials of Construction	1/3
CE 3030	Fundamentals of Civil Engineering Autocad	1/3
CE 3031	Building Information Modeling: Software Tools and Principles	1/3
CE 3041	Soil Mechanics	1/3
CE 3044	Foundation Engineering	1/3
CE 3050	Traffic Engineering	1/3
CE 3051	Pavement Engineering	1/3
CE 3059	Environmental Engineering	1/3
CE 3060	Water Treatment	1/3
CE 3061	Sustainable Wastewater Engineering: Treatment and Reuse	1/3
CE 3062	Hydraulics	1/3
CE 3070	Urban and Environmental Planning	1/3
CE 3074	Environmental Analysis	1/3
CE 4007	Matrix Analysis of Structures	1/3
CE 4060	Environmental Engineering Laboratory	1/3
CE 4061	Hydrology	1/3
CE 4063/CHE 4063	Transport & Transformations in the Environment	1/3
CE 4071	Land Use Development and Controls	1/3
CE 4600	Hazardous and Industrial Waste Management	1/3
CE 4610	Solid Waste Engineering	1/3

2000+ Level Chemical Engineering (CHE) Courses

Item #	Title	Units
CE 4063/CHE 4063	Transport & Transformations in the Environment	1/3
CHE 2011	Chemical Engineering Fundamentals	1/3
CHE 2012	Elementary Chemical Processes	1/3
CHE 2013	Applied Chemical Engineering Thermodynamics	1/3
CHE 2014	Advanced Chemical Processes	1/3
CHE 2301/ME 2301	Nanobiotechnology Laboratory Experience	1/3
CHE 3201	Kinetics and Reactor Design	1/3
CHE 3301	Introduction to Biological Engineering	1/3
CHE 3501	Applied Mathematics in Chemical Engineering	1/3
CHE 3702	Energy Challenges in the 21st Century	1/3
CHE 3722	Bioenergy	1/3
CHE 4401	Unit Operations of Chemical Engineering I	1/3
CHE 4402	Unit Operations of Chemical Engineering II	1/3
CHE 4403	Chemical Engineering Design	1/3
CHE 4404	Chemical Plant Design Project	1/3
CHE 4405	Chemical Process Dynamics and Control Laboratory	1/3
CHE 4410	Chemical Process Safety Design	1/3

Item #	Title	Units
BCB 4002/CS 4802	Biovisualization	1/3
BCB 4003/CS 4803	Biological and Biomedical Database Mining	1/3
CS 2011	Introduction to Machine Organization and Assembly Language	1/3
CS 2022/MA 2201	Discrete Mathematics	1/3
CS 2102	Object-Oriented Design Concepts	1/3
CS 2103	Accelerated Object-Oriented Design Concepts	1/3
CS 2119	Application Building with Object-Oriented Concepts	1/3
CS 2223	Algorithms	1/3
CS 2301	Systems Programming for Non-Majors	1/3
CS 2303	Systems Programming Concepts	1/3
CS 3013	Operating Systems	1/3
CS 3041	Human-Computer Interaction	1/3
CS 3043	Social Implications of Information Processing	1/3
CS 3133	Foundations of Computer Science	1/3
CS 3431	Database Systems I	1/3
CS 3516	Computer Networks	1/3
CS 3733	Software Engineering	1/3
CS 4032/MA 3257	Numerical Methods for Linear and Nonlinear Systems	1/3
CS 4033/MA 3457	Numerical Methods for Calculus and Differential Equations	1/3
CS 4099	Special Topics in Computer Science	1/3
CS 4100/IMGD 4100	Artificial Intelligence for Interactive Media and Games	1/3
CS 4120	Analysis of Algorithms	1/3
CS 4123	Theory of Computation	1/3
CS 4233	Object-Oriented Analysis and Design	1/3
CS 4241	Webware: Computational Technology for Network Information Systems	1/3
CS 4300/IMGD 4300	Graphics, Simulation, and Aesthetics	1/3
CS 4341	Introduction to Artificial Intelligence	1/3
CS 4342	Machine Learning	1/3
CS 4401	Software Security Engineering	1/3
CS 4404	Tools and Techniques in Computer Network Security	1/3
CS 4432	Database Systems II	1/3
CS 4433/DS 4433	Big Data Management and Analytics	1/3
CS 4445	Data Mining and Knowledge Discovery in Databases	1/3
CS 4513	Distributed Computing Systems	1/3
CS 4515	Computer Architecture	1/3
CS 4516	Advanced Computer Networks	1/3
CS 4518	Mobile and Ubiquitous Computing	1/3
CS 4533	Techniques of Programming Language Translation	1/3
CS 4536	Programming Languages	1/3
CS 4731	Computer Graphics	1/3
CS 4732	Computer Animation	1/3
CS 4801/ECE 4802	Introduction to Cryptography and Communication Security	1/3
CS 4804	Data Visualization	1/3
MA 3457/CS 4033	Numerical Methods for Calculus and Differential Equations	1/3

2000+ Level Electrical and Computer Engineering (ECE) Courses

Item #	Title	Units
BME 4011/ECE 4011	Biomedical Signal Analysis	1/3
BME 4023/ECE 4023	Biomedical Instrumentation Design	1/3
CS 4801/ECE 4802	Introduction to Cryptography and Communication Security	1/3
ECE 2010	Introduction to Electrical and Computer Engineering	1/3
ECE 2019	Sensors, Circuits, and Systems	1/3
ECE 2029	Introduction to Digital Circuit Design	1/3
ECE 2049	Embedded Computing in Engineering Design	1/3
ECE 2112	Electromagnetic Fields	1/3
ECE 2201	Microelectronic Circuits I	1/3
ECE 2305	Introduction to Communications and Networks	1/3
ECE 2311	Continuous-Time Signal and System Analysis	1/3
ECE 2312	Discrete-Time Signal and System Analysis	1/3
ECE 2799	Electrical and Computer Engineering Design	1/3
ECE 3012	Introduction to Control Systems Engineering	1/3
ECE 3113	Introduction to RF Circuit Design	1/3
ECE 3204	Microelectronic Circuits II	1/3
ECE 3308	Introduction to Wireless Networks	1/3
ECE 3311	Principles of Communication Systems	1/3
ECE 3500	Electric Power and Renewable Energy Systems	1/3
ECE 3501	Electromechanical Energy Systems	1/3
ECE 3829	Advanced Digital System Design with FPGAs	1/3
ECE 3849	Real-Time Embedded Systems	1/3
ECE 4305	Software-Defined Radio Systems and Analysis	1/3
ECE 4503	Power Electronics And Power Management	1/3
ECE 4703	Real-Time Digital Signal Processing	1/3
ECE 4801	Computer Organization and Design	1/3
ECE 4902	Analog Integrated Circuit Design	1/3
ECE 4904	Semiconductor Devices	1/3

2000+ Level Engineering Science Interdisciplinary (ES) Courses

Item #	Title	Units
ES 2001	Introduction to Materials Science	1/3
ES 2501	Introduction to Static Systems	1/3
ES 2502	Stress Analysis	1/3
ES 2503	Introduction to Dynamic Systems	1/3
ES 2800	Environmental Impacts of Engineering Decisions	1/3
ES 3001	Introduction to Thermodynamics	1/3
ES 3002	Mass Transfer	1/3
ES 3003	Heat Transfer	1/3
ES 3004	Fluid Mechanics	1/3
ES 3011	Control Engineering I	1/3
ES 3323	Advanced Computer Aided Design	1/3
ES 3501	A Project-Based Introduction to Systems Engineering	1/3

2000+ Level Fire Protection Engineering (FP) Courses

Item #	Title	Units
FP 3070	Introduction to Fire Protection Engineering	1/3
FP 3080	Introduction to Building Fires Safety System Design	1/3
FP 4000	Fire Laboratory	1/3
FP 4001	Fire, Risk, and Sustainability	1/3

2000+ Level Mechanical and Materials Engineering (ME) Courses

Item #	Title	Units
BME 4504/ME 4504	Biomechanics	1/3
BME 4606/ME 4606	Biofluids	1/3
BME 4814/ME 4814	Biomaterials	1/3
CHE 2301/ME 2301	Nanobiotechnology Laboratory Experience	1/3
ME 2300	Introduction to Engineering Design	1/3
ME 2312	Introduction to Computational Solutions for Engineering Problems	1/3
ME 2820	Materials Processing	1/3
ME 3310	Kinematics of Mechanisms	1/3
ME 3311	Dynamics of Mechanisms and Machines	1/3
ME 3320	Design of Machine Elements	1/3
ME 3411	Intermediate Fluid Mechanics	1/3
ME 3501	Elementary Continuum Mechanics	1/3
ME 3506	Rehabilitation Engineering	1/3
ME 3801	Experimental Methods in Material Science and Engineering	1/3
ME 3820	Computer-Aided Manufacturing	1/3
ME 3901	Engineering Experimentation	1/3
ME 3902	Project-Based Engineering Experimentation	1/3
ME 4320	Advanced Engineering Design	1/3
ME 4323	Fundamentals of Drivetrain Systems	1/3
ME 4324	Integrated Design of Mechanical Systems	1/3
ME 4422	Design and Optimization of Thermal Systems	1/3
ME 4424	Radiation Heat Transfer Application and Design	1/3
ME 4429	Thermofluid Application and Design	1/3
ME 4430	Integrated Thermomechanical Design and Analysis	1/3
ME 4505	Advanced Dynamics	1/3
ME 4506	Mechanical Vibrations	1/3
ME 4512	Introduction to the Finite Element Method	1/3
ME 4710	Gas Turbines for Propulsion and Power Generation	1/3
ME 4813	Ceramics and Glasses for Engineering Applications	1/3
ME 4821	Plastics	1/3
ME 4832	Corrosion and Corrosion Control	1/3
ME 4840	Physical Metallurgy	1/3
ME 4875/MTE 575	Introduction to Nanomaterials and Nanotechnology	1/3
RBE 4322/ME 4322	Modeling and Analysis of Mechatronic Systems	1/3

2000+ Level Robotics Engineering (RBE) Courses

Item #	Title	Units
RBE 2001	Unified Robotics I: Actuation	1/3
RBE 2002	Unified Robotics II: Sensing	1/3
RBE 3001	Unified Robotics III: Manipulation	1/3
RBE 3002	Unified Robotics IV: Navigation	1/3
RBE 3100	Social Implications of Robotics	1/3
RBE 4322/ME 4322	Modeling and Analysis of Mechatronic Systems	1/3
RBE 4540	Vision-based Robotic Manipulation	1/3
RBE 4815	Industrial Robotics	1/3

Subdisciplines Within ECE

Given a solid foundation, the MQP will allow you to demonstrate an in-depth understanding of one or more of the subdisciplines that compose the field of electrical and computer engineering. As a guide to the areas of study that can be investigated in an MQP, the ECE Course Flowchart identifies seven subdisciplines as possible areas for in-depth study leading to an MQP. Note that students should not feel constrained by these area designations — this is only one of many possible ways to organize the diverse field of electrical and computer engineering. Many if not most MQPs will incorporate subject matter from several different subdisciplines. The purpose of this list is to guide students interested in a particular area to coursework within a subdiscipline (Area Courses), relevant courses to choose from outside the subdiscipline (Related Courses), and faculty whose research and MQP advising interests fall within the subdiscipline (Area Consultants).

Robotics

Area Consultants: Michalson, Wyglinski

Area Courses

Item #	Title	Units
ECE 2029	Introduction to Digital Circuit Design	1/3
ECE 2049	Embedded Computing in Engineering Design	1/3
ECE 3849	Real-Time Embedded Systems	1/3
ES 3011	Control Engineering I	1/3

Related Courses

Item #	Title	Units
CS 4341	Introduction to Artificial Intelligence	1/3
ECE 2201	Microelectronic Circuits I	1/3
RBE 1001	Introduction to Robotics	1/3
RBE 2001	Unified Robotics I: Actuation	1/3
RBE 2002	Unified Robotics II: Sensing	1/3
RBE 3001	Unified Robotics III: Manipulation	1/3
RBE 3002	Unified Robotics IV: Navigation	1/3

Power Systems Engineering

Area Consultants: Noetscher

Area Courses

Item #	Title	Units
ECE 3500	Electric Power and Renewable Energy Systems	1/3
ECE 3501	Electromechanical Energy Systems	1/3
ECE 4503	Power Electronics And Power Management	1/3

Related Courses

Item #	Title	Units
ES 3001	Introduction to Thermodynamics	1/3
ES 3011	Control Engineering I	1/3
ME 1800	Manufacturing Science, Prototyping, and Computer-Controlled Machining	1/3
OIE 2850	Engineering Economics	1/3

RF Circuits and Microwaves

Area Consultants: Ludwig, Makaroff

Area Courses

Item #	Title	Units
ECE 2112	Electromagnetic Fields	1/3
ECE 3113	Introduction to RF Circuit Design	1/3

Related Courses

Item #	Title	Units
MA 4451	Boundary Value Problems	1/3
PH 3301	Electromagnetic Theory	1/3

Communications and Signal Analysis

Area Consultants: Brown, Clancy, Makaroff, Pahlavan, Tang, Wyglinski

Area Courses

Item #	Title	Units
ECE 2305	Introduction to Communications and Networks	1/3
ECE 2312	Discrete-Time Signal and System Analysis	1/3
ECE 3308	Introduction to Wireless Networks	1/3
ECE 3311	Principles of Communication Systems	1/3
ECE 4305	Software-Defined Radio Systems and Analysis	1/3
ECE 4703	Real-Time Digital Signal Processing	1/3

Related Courses

Item #	Title	Units
ES 3011	Control Engineering I	1/3
MA 2071	Matrices and Linear Algebra I	1/3
MA 2621	Probability for Applications	1/3
MA 4291	Applied Complex Variables	1/3

Biomedical Engineering

Area Consultants: Clancy

Area Courses

Item #	Title	Units
BME 4011/ECE 4011	Biomedical Signal Analysis	1/3
BME 4023/ECE 4023	Biomedical Instrumentation Design	1/3

Related Courses

Item #	Title	Units
BME 4201	Biomedical Imaging	1/3
ECE 2201	Microelectronic Circuits I	1/3
ECE 2312	Discrete-Time Signal and System Analysis	1/3
ECE 3204	Microelectronic Circuits II	1/3

Analog Microelectronics

Area Consultants: Bitar, Guler, Ludwig

Area Courses

Item #	Title	Units
ECE 2201	Microelectronic Circuits I	1/3
ECE 3204	Microelectronic Circuits II	1/3
ECE 4902	Analog Integrated Circuit Design	1/3
ECE 4904	Semiconductor Devices	1/3

Related Courses

Item #	Title	Units
ES 3011	Control Engineering I	1/3

Computer Engineering

Area Consultants:Clancy, Huang, Michalson, Sunar

Area Courses

Item #	Title	Units
ECE 2029	Introduction to Digital Circuit Design	1/3
ECE 2049	Embedded Computing in Engineering Design	1/3
ECE 3829	Advanced Digital System Design with FPGAs	1/3
ECE 3849	Real-Time Embedded Systems	1/3
ECE 4801	Computer Organization and Design	1/3

Related Courses

Item #	Title	Units
CS 2223	Algorithms	1/3
CS 3013	Operating Systems	1/3
CS 4515	Computer Architecture	1/3
CS 4536	Programming Languages	1/3
ECE 2201	Microelectronic Circuits I	1/3

Course Flow Chart