

Department of Electrical and Electronic Engineering

Microelectronics Science and Engineering

I. Introduction

The features of microelectronics include: (1) Frontier and Fundamental Research. The direction of the discipline covers three aspects, including the development of integrated circuit technology; integrated circuit devices and materials research and MEMS / NEMS devices with micro-nanofabrication technology; integrated circuit design. (2) Outstanding application. Applications include low-power logic and memory electronics, smart mobile devices, wireless sensor networks, new thin film materials, green energy, etc.

II. Objectives

The Microelectronic Science and Engineering major aims to provide students not only solid theoretical knowledge in semiconductor materials and devices, but also practical skills to design and manufacture state-of-the-art electronic and optoelectronic devices and systems. Upon graduation, students are expected to write and speak fluent English, use computers proficiently, and apply those skills in interdisciplinary collaborations and innovative research and development (R&D) activities. Our undergraduate students can work in diverse areas, including the design and manufacturing of electronic and optoelectronic devices and integrated circuits and systems, and the R&D of innovative products, technologies and processes. Students can either continue post-graduate education in microelectronics or related fields after graduation, or pursue research, development, education, and management positions at a broad spectrum of enterprises, research institutes, and universities.

III. Period of Study and Degree Requirement

Time length: 4 years

Prerequisites: College Physics, College English, Calculus, Linear Algebra, Engineering Mathematics, General Chemistry, General Physics, Engineering Drawing, Engineering electromagnetics.

Degree conferred: Bachelor of Engineering

The minimum credit requirement for graduation: 152.5 credits

IV. Disciplines

Major disciplines includes Microelectronics Science and Engineering, Opto-electronic Information Science and Engineering .etc.

V. Main Courses

Core courses include Calculus, Linear Algebra, Engineering Mathematics, General Chemistry, General Physics, Engineering Drawing, Solid-State Electronics, Analog Circuit, Digital Circuit, Introduction to Semiconductor Devices, Engineering Electromagnetics, Fundamental of Optoelectronic Technology, Introduction to MEMS, Introduction to Display and Lighting Technologies, Introduction to VLSI Technology, Integrated Circuit Design .etc.

VI. Practice - Based Courses

Core practical training includes Microelectronic related experiments, and VLSI Technology training, Photovoltaic Technology practice, Microelectronic related innovative experiment, Industrial Practice, Advanced Electronic Science Experiment I (It is a subject elective course. Outstanding students after their junior year, can join research working with their professor), and all sorts of domestic and international academic competitions, like solar energy motor contest .etc.

Major professional experiment includes Analog Circuit experiment, Digital Circuit experiment, Semiconductor Devices experiment, basic Optical experiment, Solar battery manufacturing and System developing experiments, LED manufacturing and system developing .etc.

VII. Course Structure and Credit Requirements

General Education (GE) Required Courses: 66.5 credits; (General Physics A)

General Education (GE) Elective Courses: 10 credits;

Major Foundational Courses: 22 credits;

Major Core Courses: 17credits;

Major Elective Courses: 25 credits;

Undergraduate Thesis/Projects, Research Projects and Internship: 12 credits;

The minimum credits requirement for graduation: 152.5 credits.

VIII. Course Arrangement

Table 1: Major Required Courses (Foundational and Core Courses)

Major Required Courses	Course Code	Course Name	Credit	Lab Credits	Hours /week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept
Foundational Courses	ME102	CAD and Engineering Design	3	1	4	Spr. /Fall	1/Spr.	C	NA	ME
	EE104	Fundamentals of Electric Circuits	2		2	Spr.	1/Spr.	C/E	MA101b MA102b MA103b	EE
	EE201	Analog circuit	4	1	5	Fall	2/Fall	C	MA103b PHY101a PHY102a EE104	
	EE203	Solid-state electronics	3		3	Fall	2/Fall	C/E	MA101b MA102b PHY101a PHY102a	
	EE202	Digital Circuit	4	1	5	Spr.	2/Spr.	C	PHY102a EE203 EE201	
	EE204	Introduction to Semiconductor Devices	3	1	4	Spr.	2/Spr.	C/E	EE203	
	EE208	Engineering electromagnetics	3	1	4	Spr.	2/Spr.	C/E	MA101b MA102b MA103b EE104	
	Total		22	5	27					
Core Courses	EE301	Frontier Seminars in Modern Electronic Science and Technology I	1		1	Fall	3/Fall	C/E	NA	EE

	EE303	Fundamental of Optoelectronic Technology	3	1	4	Fall	3/Fall	C/E	NA	
	EE305	Introduction to VLSI Technology	3	1	4	Fall	3/Fall	C/E	EE202	
	EE302	Frontier Seminars in Modern Electronic Science and Technology II	1		1	Spr.	3/Spr.	C/E	NA	
	EE304	Integrated circuit design	3	2	5	Spr.	3/Spr.	C/E	MA101b MA102b EE202 EE204	
	EE306	Introduction to MEMS	3	1	4	Spr.	3/Spr.	E	PHY101a PHY102a	
	EE401	Frontier Seminars in Modern Electronic Science and Technology III	1		1	Fall	4/Fall	C/E	NA	
	EE403	Introduction to Display and Lighting Technologies	2		2	Fall	4/Fall	C/E	EE203 EE204 EE311	
	Total		17	5	22					
EE470	Internship	2	2	16	Smr.	3/Smr.	NA	NA	EE	
EE480	Research Projects	2	2				NA	NA		
EE490	Undergraduate Thesis/Projects	8	8	8	Fall Spr.	4/Fall &Spr.	NA	NA		
Total		12	12	24						
*Note: Internship will last approximately 4 to 6 weeks, 14 to16 hours per week.										
**Note: Students can choose whatever term they like to select Research Projects course, so it is not listed on advised term to take the course. Minimum learning hours of this course are 48 to 64 hours in total.										

Table 2: Major Elective Courses

Course Code	Course Name	Credits	Lab Credits	Hours /week	Terms	Advised term to take the	Instruction language	Prerequisite	Dept.
EE205	Signals and Systems	3	1	4	Fall	2/Fall	C/E	NA	
PHY206	Quantum Mechanics I	3		3	Spr.	2/Spr.	C	PHY205	PHY
CS203	Data Structures and Algorithm Analysis	3	1	4	Fall	2/Fall	C	NA	CS
EE316	Microwave Engineering	3	1	4	Spr.	3/Spr.	E	EE104 EE201 EE208	
EE317	Advanced Electronic Science Experiment I*	1	1	2	Fall	3/Fall	NA	NA	
EE318	Advanced Electronic Science Experiment II	1	1	2	Spr.	3/Spr.	NA	NA	
CS301	Embedded System and Microcomputer Principle	3	1	4	Fall	3/Fall	C/E	NA	CS
BIO214	Biomedical Instrumentation and Experiment	3	1	4	Spr.	2/Spr.	C	NA	BIO
EE320	Integrated Circuit Fabrication	3	1.5	4.5	Spr. /Fall	3/Spr./Fall	C	EE203	
EE322	Optoelectronics Devices Fabrication	2	1	3	Spr.	3/Spr.	C/E	EE203 EE204 EE303 EE309 EE310	
MSE308	Energy Materials Science	3	1	4	Spr.	3/Spr.	C/E	PHY101 PHY102 PHY104 MSE201	MSE
MSE320	Introduction to Photovoltaic Thermal Technology	3		3	Spr.	3/Spr.	C/E	PHY101 PHY102 EE201 PHY312	MSE

EE405	Advanced Electronic Science Experiment III	1	1	2	Fall	4/Fall	NA	NA	
EE407	Energy Harvesting Technologies	3		3	Fall	4/Fall	C/E	NA	
EE419	Biosensor	3	1	4	Fall	4/Fall	E	NA	
EE402	Frontier Seminars in Modern Electronic Science and Technology IV	1		1	Spr.	4/Spr.	C/E	NA	
EE206	Communication Principles	3	1	4	Spr.	2/Spr.	C/E	EE205	
EE210	Fundamentals of Optics	3		3	Spr.	2/Spr.	C/E	NA	
EE307	Antennas and Radio Propagation	3	1	4	Fall	3/Fall	C/E	EE104 EE201 EE208	
EE309	Introduction to Semiconductor Optics	3		3	Fall	3/Fall	C/E	EE203	
EE310	Principles and Technologies of Lasers	3		3	Spr.	3/Spr.	C/E	NA	
EE311	Optical Design	3	1	4	Fall	3/Fall	C/E	PHY307	
EE313	Wireless Communications	3	1	4	Fall	3/Fall	C/E	EE206	
EE314	Communications System Design I	2	2	4	Spr	3/Spr.	C/E	EE313	
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	E	EE205	
EE326	Digital Image Processing	3	1	4	Spr.	3/Spr.	E	EE323	
EE328	Speech Signal Processing	3	1	4	Spr.	3/Spr.	E	EE323	
EE330	DSP Design and Simulation	1.5	1.5	3	Spr.	3/Spr.	C/E	EE323	
EE332	Digital System Design	3	1	4	Spr.	3/Spr.	E	EE323	
MA212	Probability Theory and Statistics	3		3	Spr.	2/Spr.	C/E	MA101 MA102 MA103	MA
PHY321	Introduction to Solid State Physics	4		4	Fall	3/Fall	C/E	PHY206	PHY
PHY423	Physics of Thin Films	3		3	Fall	4/Fall	E	PHY321 PHY204	PHY
PHY425	Modern Techniques in Materials Characterization	3	1	4	Fall	4/Fall	C/E	PHY206	PHY
BMEB13 7	Introduction to Biomedical Engineering	2		2	Spr.	1/Spr.	C	NA	BIO
BMEB31 7	Principles of Medical Imaging Systems	3		3	Spr.	3/Spr.			BIO
CH102	General Chemistry Laboratory	1	1	2	Spr.	1/Spr.			CH
CH212	Advanced Instrumentation Systems I	3	1	4	Spr.	2/Spr.			CH
CH304	Nanomaterials Synthesis and Nanotechnology	2		2	Spr.	3/Spr.			CH

CH305	Instrumental Analysis	4	2	6	Fall	3/F			CH
CH306	Laboratory for Micro-Nano Synthesis, Technology and Application	2		2	Spr.	3/Spr.			CH
CH407	Elected Topics in Nanoscience and Nanotechnology	3		3	Fall	4/Fall			CH
CS401	Intelligent Robot	3	1	4	Fall	4/Fall	C/E		CS
ESE212	Environment Monitoring	3		3	Spr.	2/Spr.			ESE
ESE407	Introduction to Numerical Simulation Methods	3		3	Fall	4/Fall			ESE
MA110	MATLAB Programming and Application	3	1	4	Spr.	1/Spr.	C/E	MA103	MA
MA202	Complex Analysis	3		3	Spr.	2/Spr.	C/E	MA101 MA102 MA103	MA
MA206	Mathematical Modelling	3	1	4	Spr.	2/Spr.			MA
MA303	Partial Differential Equations	3		3	Fall	3/Fall	C/E	MA101 MA102 MA103M A201	MA
MA305	Numerical Analysis	3		3	Fall	3/Fall	C	MA101 MA102 MA103	MA
MAE202	Mechanics of Materials	3		3	Spr.	2/Spr.	C	MAE203	MAE
MAE303	Fluid Mechanics	4	1	5	Fall	3/Fall	E	MAE204	MAE
MAE305	Engineering Thermodynamics	3		3	Fall	3/Fall	C	NA	MAE
MAE411	Micro and Nano Mechanics	3		3	Fall	4/Fall	C	NA	MAE
ME310	Fundamentals of Measurement Technology	3		3	Spr.	3/Spr.	C/E	EE205 ME307	ME
ME411	New Energy Technology	3	1	4	Fall	4/Fall	C/E	ME304	ME
MSE102	Frontier Seminars in Materials Science and Engineering	1		1	Spr.	1/Spr.	C/E	NA	MSE
MSE403	Advanced Materials Characterization Techniques	3	1.5	4.5	Spr.	4/Spr.	E	NA	MSE
MSE413	3D Printing and Laser-based Advanced Manufacturing	3		3	Fall	4/Fall	E	PHY311 MA101 MA102	MSE

PHY322	Lectures on Elected Research Software	2		2	Spr.	3/Spr.	C	GE105 PHY101 PHY102 MA101 MA102	PHY
MA201b	Ordinary Differential Equations B	4		4	Smr.	2/Smr.	C/E	MA101 MA102 MA103	MA
EE106	Introduction to Optoelectronic	2		2	Spr.	1/Spr.	C	NA	
EE308	Fiber Communication Principles and Techniques	3	1	4	Spr.	3/Spr.	C/E	EE303	
EE321	Spectral Technology and Application	3		3	Fall	3/Fall	C/E	NA	
EE324	Laser Microfabrication	3		3	Spr.	3/Spr.	C/E	NA	
EE325	Nonlinear Optimization Techniques for Electrical Engineering	3	1	4	Fall	3/Fall	C/E	MA101b MA102b MA103b	
EE409	Ultrafast Photonics	3	1	4	Fall	4/Fall	C/E	NA	
EE411	Information Theory and Coding	2		2	Fall	4/Fall	C/E	MA101b MA102b MA103b MA212	
EE417	Communications System Design II	2	2	4	Fall	4/Fall	E	EE316 EE307 EE206	
EE423	Pattern Recognition	2		2	Fall	4/Fall	C/E	EE323 EE326	
EE427	Principles of Remote Sensing	2		2	Fall	4/Fall	C/E	EE323 EE326	
EE327	Fundamentals of Information Optics	3	1	4	Fall	3/F	C/E	EE205	
EE329	Liquid crystal optoelectronics	2	1	3	Fall	3/F	C	EE210	
EE331	Fundamentals of the 3rd generation Semiconductors	2		2	Fall	3/F	C/E	EE203or EE204	
EES101	Brief Introduction of Creative Electronic Design I	1	0.5	6	Sum	3/ Sum	C	PHY101a PHY102a	
EES102	DIY Project: Assembling an iphone6	2	2	8	Sum	3/ Sum	C	NA	
EES201	Brief Introduction of Creative Electronic Design II	0.5	0.5	4	Sum	6/ Sum	C	NA	
EES202	Design Based on LabVIEW	1	1	8	Sum	6/ Sum	C	NA	

	Programming								
EES203	Innovation and Entrepreneurship	0.5	0.5	4	Sum	6/ Sum	C	NA	
EES204	Fiber Sense Design	1	1	8	Sum	6/ Sum	C	NA	
EES205	Advanced Technology Forecasting	1.5		6	Sum	6/ Sum	E	NA	
EES301	Statistical Machine Learning	2		8	Sum	9/ Sum	E	MA103b	
EES302	2D Materials: Properties and Devices	2		8	Sum	9/ Sum	E	NA	
Total		208	47.5	297.5					
<p>*Note: To meet the graduate criteria, one must select at least 25 credits course from above.</p> <p>**Note: Advanced Electronic Science Experiment can be selected by outstanding senior students. This course will allow those students accomplish researching work with their professors.</p>									

Table 3: Overview of Practice-Based Courses

Course Code	Course Name	Credits	Lab Credits	Hours /week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
ME102	CAD and Engineering Design	3	1	4	Fall /Spr.	1/Spr.	C	NA	MA
EE201	Analog Circuit	4	1	5	Fall	2/Fall	C	MA103b PHY101a PHY102a EE104	
EE202	Digital Circuit	4	1	5	Spr.	2/Spr.	C	PHY102a EE203 EE201	
EE204	Introduction to Semiconductor Devices	3	1	4	Spr.	2/Spr.	C/E	EE203	
EE208	Engineering Electromagnetics	3	1	4	Spr.	2/Spr.	C/E	MA101b MA102b MA103b EE104	
EE303	Fundamental of Optoelectronic Technology	3	1	4	Fall	3/Fall	C/E	NA	
EE305	Introduction to VLSI Technology	3	1	4	Fall	3/Fall	C/E	EE202	
EE304	Integrated Circuit Design	3	2	5	Spr.	3/Spr.	C/E	MA101b MA102b EE202 EE204	
EE306	Introduction to MEMS	3	1	4	Spr.	3/Spr.	E	PHY101a PHY102a	
EE470	Industrial Practice	2	2	16	Smr.	3/Smr.	NA	NA	
EE480	Projects of Science and Technology Innovation	2	2				NA	NA	
EE490	Thesis(Graduation Project)	8	8	8	Spr. &Fall	4/Spr. &Fall	NA	NA	
EE205	Signals and Systems	3	1	4	Fall	2/Fall	C/E	NA	

CS203	Data Structures and Algorithm Analysis	3	1	4	Fall	2/Fall	C	NA	CS
EE316	Microwave Engineering	3	1	4	Spr.	3/Spr.	E	EE104 EE201 EE208	
EE317	Advanced Electronic Science Experiment I*	1	1	2	Fall	3/Fall	NA	NA	
EE318	Advanced Electronic Science Experiment II	1	1	2	Spr.	3/Spr.	NA	NA	
CS301	Embedded System and Microcomputer Principle	3	1	4	Fall	3/Fall	C/E	NA	CS
EE320	Integrated Circuit Fabrication	3	1.5	4.5	Spr./Fall	3/Spr./Fall	C	EE203	
EE322	Optoelectronics Devices Fabrication	2	1	3	Spr.	3/Spr.	C/E	EE203 EE204 EE303 EE309 EE310	
MSE308	Energy Materials Science	3	1	4	Spr.	3/Spr.	C/E	PHY101 PHY102 PHY104 MSE201	MSE
EE405	Advanced Electronic Science Experiment III	1	1	2	Fall	4/Fall	NA	NA	
EE419	Biosensor	3	1	4	Fall	4/Fall	E	NA	
EE206	Communication Principles	3	1	4	Spr.	2/Spr.	C/E	EE205	
EE307	Antennas and Radio Propagation	3	1	4	Fall	3/Fall	C/E	EE104 EE201 EE208	
EE311	Optical Design	3	1	4	Fall	3/Fall	C/E	PHY307	
EE313	Wireless Communications	3	1	4	Fall	3/Fall	C/E	EE206	
EE314	Communications System Design I	2	2	4	Spr.	3/Spr.	C/E	EE313	
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	E	EE205	
EE326	Digital Image Processing	3	1	4	Spr.	3/Spr.	E	EE323	
EE328	Speech Signal Processing	3	1	4	Spr.	3/Spr.	E	EE323	
EE330	DSP Design and Simulation	1.5	1.5	3	Spr.	3/Spr.	C/E	EE323	
EE332	Digital System Design	3	1	4	Spr.	3/Spr.	E	EE323	
PHY425	Modern Techniques in Materials	3	1	4	Fall	4/Fall	C/E	PHY206	PHY

	Characterization								
BIO214	Biomedical Instrumentation	3	1	4	Spr.	2/Spr.			BIO
CH102	General Chemistry Laboratory	1	1	2	Spr.	1/Spr.			CH
CH212	Advanced Instrumentation Systems I	3	1	4	Spr.	2/Spr.			CH
CH305	Instrumental Analysis	4	2	6	Fall	3/Fall			CH
CS401	Intelligent Robot	3	1	4	Fall	4/Fall	C/E		CS
CS407	Virtual Reality Technology	3	1	4	Fall	4/Fall	C/E	GE105	CS
MA110	MATLAB Programming and Application	3	1	4	Spr.	1/Spr.	C/E	MA103	MA
MA206	Mathematical Modelling	3	1	4	Spr.	2/Spr.			MA
MAE303	Fluid Mechanics	4	1	5	Fall	3/Fall	E	MAE204	MAE
ME411	New Energy Technology	3	1	4	Fall	4/Fall	C/E	ME304	ME
MSE403	Advanced Materials Characterization Techniques	3	1.5	4.5	Spr.	4/Spr.	E	NA	MSE
EE308	Fiber Communication Principles and Techniques	3	1	4	Spr.	3/Spr.	C/E	EE303	
EE325	Nonlinear Optimization Techniques for Electrical Engineering	3	1	4	Fall	3/Fall	C/E	MA101b MA102b MA103b	
EE409	Ultrafast Photonics	3	1	4	Fall	4/Fall	C/E	NA	
EE417	Communications System Design II	2	2	4	Fall	4/Fall	E	EE316 EE307 EE206	
EE327	Fundamentals of Information Optics	3	1	4	Fall	3/F	C/E	EE205	
EE329	Liquid crystal optoelectronics	2	1	3	Fall	3/F	C	EE210	
EES101	Brief Introduction of Creative Electronic Design I	1	0.5	6	Sum	3/ Sum	C	PHY101a PHY102a	
EES102	DIY Project: Assembling an iphone6	2	2	8	Sum	3/ Sum	C	NA	
EES201	Brief Introduction of Creative Electronic Design II	0.5	0.5	4	Sum	6/ Sum	C	NA	
EES202	Design Based on LabVIEW Programming	1	1	8	Sum	6/ Sum	C	NA	
EES203	Innovation and Entrepreneurship	0.5	0.5	4	Sum	6/ Sum	C	NA	
EES204	Fiber Sense Design	1	1	8	Sum	6/ Sum	C	NA	

Total	149.5	69.5	245.5					
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Table 4: Overview of Course Hours and Credits

Course Category	Total Course Hours	Total Credits	The Minimum Credit Requirement
General Education (GE) Required Courses	1168	66.5	66.5
General Education (GE) Elective Courses	3144	182.5	10
Major Foundational Courses	432	22	22
Major Core Courses	352	17	17
Major Elective Courses	4848	208	25
Internship, Research Projects, and Undergraduate Thesis/Projects	Estimated 380	12	12
Total	10324	508	152.5