Semiconductor Science and Engineering (MSE)

The MSE in Semiconductor Science and Engineering will prepare students to enter the semiconductor workforce in areas such as semiconductor manufacturing, semiconductor device design, semiconductor circuit and system design, semiconductor metrology, semiconductor packaging and heterogeneous integration.

Semiconductor Manufacturing. This track focuses on gaining a fundamental understanding of semiconductor manufacturing processes and tools as well as hands-on experience using those tools. Required laboratories in this track include semiconductor manufacturing, where will gain experience with common semiconductor fabrication methods such as wafer cleaning, spin coating, photolithography, resist development, wet and dry etching, metal deposition, chemical vapor deposition, ion implantation, annealing and wafer bonding, as well semiconductor metrology and characterization, where students will gain experience with common semiconductor metrology methods such as profilometry, optical microscopy, scanning electron microscopy, atomic force microscopy, ellipsometry, interferometry, and electrical probing. Electives in this track include courses focused on analysis, modeling and control of semiconductor manufacturing processes, ultra-large scale integration techniques, optical and machine tool design for semiconductor equipment, plasma processing, lithography, and practical metrology methods.

Semiconductor Circuit and System Design. This track focuses on developing the knowledge and skills necessary to design semiconductor circuits and systems. Required laboratories in this track include very-large scale integration (VLSI) circuit design, where students will explore complementary metal oxide semiconductor (CMOS) technology; static and dynamic CMOS combinational and sequential circuits; design of Datapath elements; performance, power consumption, and testing and the use computer-aided design (CAD) tools for layout, timing analysis, synthesis, physical design, and verification, as well as analog integrated circuit design where students will explore the analysis and design of analog integrated circuits; transistor models and integrated circuit technologies; layout techniques; noise; mismatches; current mirrors; differential amplifiers; frequency response and compensation; feedback and stability; nonlinear circuits; voltage references; and operational amplifiers using state-of-the-art CAD tools for design, simulation, and layout. Electives in this track include application specific integrated circuit design, radio frequency integrated circuit design, power management design, physical design automation and optimization, system-on-chip design, embedded system design, semiconductor memory design and computer architecture.

Semiconductor Heterogenous Integration. This track focuses on gaining a fundamental understanding of advanced packaging and heterogeneous integration for semiconductor manufacturing. Required laboratories in this track include semiconductor manufacturing, where will gain experience with common semiconductor fabrication methods such as wafer cleaning, spin coating, photolithography, resist development, wet and dry etching, metal deposition, chemical vapor deposition, ion implantation, annealing and wafer bonding, as well semiconductor metrology and characterization, where students will gain experience with common semiconductor metrology methods such as profilometry, optical microscopy, scanning electron microscopy, atomic force microscopy, ellipsometry, interferometry, and electrical probing. Electives in this track include courses focused on microelectronics packaging techniques, thermomechanical issues in packaging, reliability related aspects of packaging, thermal management conditions, packaging materials, integration of heterogeneous chiplets, thin films and interfaces, and metallization.

Semiconductor Devices. This track focuses on developing the knowledge and skills necessary to design, fabricate and test new semiconductor devices. Required laboratories in this track include very-large scale integration (VLSI) circuit design, where students will explore complementary metal oxide semiconductor (CMOS) technology; static and dynamic CMOS combinational and sequential circuits; design of Datapath elements; performance, power consumption, and testing and the use computer-aided design (CAD) tools for layout, timing analysis, synthesis, physical design, and verification, as well semiconductor metrology and characterization, where students will gain experience with common semiconductor metrology methods such as profilometry, optical microscopy, scanning electron microscopy, atomic force microscopy, ellipsometry, interferometry, and electrical probing. Electives in this track include courses focused on optoelectronic devices, semiconductor heterostructures, metal-oxide-semiconductor field-effect transistors (MOSFET), bipolar junction transistors (BJT), thin-film transistors, quantum wires, quantum dots, spintronic devices, and emerging 2D devices.

Graduate Handbook

Graduate handbook information is updated and maintained by each program. Graduate handbooks are available within each program's office and online. Please contact the program with concerns or questions.

Admission

Students with a bachelor's degree in engineering or in one of the physical sciences may be admitted to the Semiconductor Science and Engineering degree program upon the recommendation of the Graduate Studies Committee. Students who do not have a background that the committee considers satisfactory for the study of Semiconductor Science and Engineering will be required to take preparatory coursework, some of which may be at the undergraduate level. Completion of some coursework may be required before the student begins the work for the graduate degree.

Total Hours Required: 30

Requirements

Students will be admitted into one of four potential tracks:

1. Semiconductor Manufacturing,
2. Circuits and Systems,
3. Heterogeneous Integration, and
4. Semiconductor Devices.

Code	Title	Hours
Degree		
SSE 398R	Master's Report (under the supervision of a research advisor)	3
SSE 395	Research	3
Laboratory courses (exact laboratory courses will depend on the track)		6
Hours chosen from: Elective hours based on chosen track		9
Additional Coursework		9
Graduate Engineering Requirements		

Graduate University Requirements	
Total Hours	**30**

Additional Requirements and Policies

Prescribed elective courses are currently offered through closely related disciplines in the Cockrell School of Engineering and the College of Natural Sciences.