Materials Science and Engineering, M.S.

Materials Science and Engineering focuses on the discovery of new materials, the tailoring of materials systems for optimum performance in a given technological application, and the design of novel materials solutions for emerging technologies. MSE is an interdisciplinary field incorporating elements of chemistry, physics, biology and/or engineering to derive and control the connections between structure (at length scales ranging from sub-atomic to macroscale), the processing necessary to achieve that structure, the fundamental properties (electrical, optical, thermal, mechanical, etc.), and their performance. These correlations are investigated using advanced materials characterization techniques and theoretical/computational analysis. Many of the most pressing scientific and technological challenges faced by humanity are constrained by the limits of currently available materials. The discovery, design and development of enabling materials is at the core of solving current and future scientific and engineering grand challenges, and benefit industries involved in electronics, advanced sensors, communications, human health, transportation, manufacturing recreation, energy conversion and storage, and environmental sustainability.

Current research programs include nanomaterials, nanostructures, nanoelectronics, nanodevices, nanocharacterization, device/system packaging materials, materials for fuel cells and related alternative energy systems, biocompatible materials, soft materials such as biological materials and polymeric materials, electronic and photonic materials, hybrid materials, interfacial engineering of materials, and multifunctional materials. Faculty with relevant research are affiliated with the Integrated Nanofabrication Research Facility (INRF), the National Fuel Cell Research Center (NFCRC), the California Institute for Telecommunications and Information Technology (Calit2), the Advanced Power and Energy Program (APEP), the Laboratory for Electron and X-ray Instrumentation (LEXI), and the Irvine Materials Research Institute (IMRI), among others.

The MSE graduate degree program is hosted by the Department of Materials Science and Engineering (MSE). Faculty who may serve as advisors are listed as affiliated with the MSE Department and include faculty with strong materials science and engineering research programs from other departments. The formal degree that is awarded upon successful completion of the program is either the M.S. or Ph.D. in Materials Science and Engineering.

Specific Fields of Emphasis

The Materials faculty at UCI have special interest and expertise in all areas of modern materials and technologies, including biomaterials, energy materials, advanced ceramics, polymers and nanocomposite materials, structural and nanostructured metallic materials, micro/nano-device materials, device/system packaging materials, and multifunctional materials.

Given the nature of Materials Science and Engineering as a cross-disciplinary program, students having a background and suitable training, in Materials, Engineering (Mechanical, Electrical, Civil, Chemical, Aerospace), and the Physical Sciences (Physics, Chemistry, Geology) are encouraged to participate. A student with an insufficient background may be required to take remedial undergraduate courses. Recommended background courses include an introduction to materials, thermodynamics, mechanical behavior, and electrical/optical/magnetic behavior.

The M.S. reflects achievement of an advanced level of competence for professional practice of materials science and engineering. Two options are available: a thesis option and a comprehensive examination option.

Required Courses

Students are required to take one course from each area for the M.S. and as a basis for the Ph.D. preliminary examination.

Crystal Structure and Defects:	
MSE 200	Crystalline Solids: Structure, Imperfections, and Properties
Electrical and Optical Behavior:	
MSE 205	Materials Physics
Mechanical Behavior:	
MSE 256A	Mechanical Behavior of Engineering Materials
Thermodynamics and Kinetics:	
MSE 265	Phase Transformations

Electives

Faculty advisors should be consulted on the selection of elective courses. All graduate courses offered in MSE are potential electives. Graduate-level courses offered in other Engineering departments and relevant graduate courses from other schools may also be taken as electives.

Plan I: Thesis Option

For the M.S. thesis option, students are required to complete a research study of great depth and originality and obtain approval for a complete program of study. A committee of three full-time faculty members is appointed to guide development of the thesis. A minimum of 36 units is required for the M.S.

For the thesis option, the following are required: four required core courses; three quarters of MSE 298 (Department Seminar); five additional graduate elective courses numbered 200–289 (or 200-295 if offered by other departments) for 3 or more units each, related to their field of graduate studies, and approved by the graduate advisor. Up to two of these elective courses can be substituted by up to eight units of MSE 296 (M.S. Thesis Research), and

one of these elective courses may be substituted by an upper-division undergraduate elective course if the course is not a part of the required MSE undergraduate core curriculum and is approved by the MSE graduate advisor.

Full-time graduate students must enroll in the departmental seminar each quarter during their first year unless exempt by petition.

Plan II: Comprehensive Examination Option

For the comprehensive examination option, students are required to complete 36 units of study and a comprehensive examination.

The following are required: four required core courses; three quarters of MSE 298 (Department Seminar); and a minimum of five additional graduate elective courses for 3 or more units numbered 200–289 (or 200-295 if offered by other departments), related to their field of graduate studies, and approved by the graduate advisor. One of these elective courses may be substituted by an upper-division undergraduate elective course if the course is not a part of the required MSE undergraduate core curriculum and is approved by the MSE graduate advisor.

Research units (MSE 296/MSE 299) do not count towards the degree requirements of the Comprehensive Exam Option. Full-time graduate students must enroll in the departmental seminar each quarter during their first year unless exempt by petition.

In addition to fulfilling the course requirements outlined above, it is a University requirement for the Master of Science degree that students fulfill a minimum of 36 units of study.