Interdisciplinary Programs
Master of Science in Materials Science and Engineering

Degree Requirements

<table>
<thead>
<tr>
<th>Master of Arts or Master of Science Interdisciplinary Studies</th>
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<td>Each program is developed individually according to the student’s interests and background but must be intellectually defensible and clearly interdisciplinary in nature. In addition to any Graduate College requirements not mentioned here, the requirements of the IDS Program are as follows:</td>
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<tr>
<td>1. Course work must be selected from a minimum of two academic areas.</td>
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<td>2. No more than 6 credits of work completed prior to approval of the degree plan by the IDS Committee may be included in the program.</td>
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<td>3. No more than 11 credits of 300G or 400G courses may be applied toward the program.</td>
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<td>4. No more than 9 transfer credits may be included in the program.</td>
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<td>5. No more than 9 credits of independent study (596) may be included in the program.</td>
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<td>6. Courses may not be challenged for credit.</td>
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<td>7. The degree will consist of a total of no less than 33 credits, of which no more than 16 credits may be earned in the College of Business. Students may select (with IDS Committee approval) from a thesis/project option or a written examination option. The thesis/project will carry 6 credits. Under either option, the student will be required to draw critically upon the two or more disciplines studied and to integrate disciplinary insights.</td>
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<tr>
<td>8. Students completing the thesis/project option will, upon completion of that option, meet with their 3-person graduate committee for a final review of the thesis or project.</td>
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<td>9. Students completing the examination option will take a written examination prepared by their 3-person graduate committee, with whom they will subsequently meet for a review of results.</td>
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<tr>
<td>10. Minor revisions to the plan of study may be approved by the Director of Interdisciplinary Studies upon the recommendation of the student’s graduate advisor; major changes must be approved by the university-wide IDS Committee.</td>
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<tr>
<td>11. All work toward the MA/MS degree in Interdisciplinary Studies must be completed within a period of seven years.</td>
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</table>

Course Offerings

INTDIS—INTERDISCIPLINARY STUDIES

INTDIS 591 PROJECT (0-V-6). Students are expected to draw critically upon the two or more disciplines studies and to integrate disciplinary insights. Before beginning the Project, a prospectus must be approved by the student’s graduate committee. After its completion, the Project must be defended at an oral examination scheduled by the graduate advisor. PREREQ: Admission to candidacy.

INTDIS 593 THESIS (0-V-6). A Thesis must reflect scholarly integration of the two or more disciplines studied and demonstrate original research or new and logical interpretation of existing data. Before beginning the Thesis, a prospectus must be approved by the student’s graduate committee. After its completion, the Thesis must be defended at an oral examination scheduled by the graduate advisor. PREREQ: Admission to candidacy.

Master of Science in Materials Science and Engineering

College of Engineering
Department of Materials Science and Engineering

Graduate Program Coordinators:
William Knowlton
Micron Engineering Center, Room 202M, Mail Stop 2075
Telephone (208) 426-5705
FAX (208) 426-2470
e-mail: bknowlton@boisestate.edu

William Hughes
Micron Engineering Center, Room 302D, Mail Stop 2075
Telephone (208) 426-4859
FAX (208) 426-2470
e-mail: willhughes@boisestate.edu

Engineering Graduate Faculty: Darryl Butt, Janet Callahan, Kris Campbell, Sean M. Donovan, Megan Frary, Will Hughes, William Knowlton, Wan Kuang, Maria Mikova, Amy Moll, Peter Müllner, Rick Ubic, Bernard Yurke

Physics Graduate Faculty: Charles Hanna, Byung-II Kim, Alex Punnoose, Pushpa Raghani, Dmitri Tenne

Chemistry and Biochemistry Graduate Faculty: Eric Brown, Henry Charlier, Jeunghoon Lee, Owen, McDougal, Dale Russell, Martin Schimpf, Don Warner

Biological Sciences Graduate Faculty: Julia Thom Oxford

General Information

The Department of Materials Science and Engineering offers two distinct graduate degree programs. The program leading to the Master of Science in Materials Science and Engineering (M.S. MSE) is a thesis-based program designed to prepare students for research and development and further study at the doctoral level. The program leading to the Master of Engineering in Materials Science and Engineering (M.Engr. MSE) is a non-thesis program with a focus on professional development. Both programs are interdisciplinary and involve faculty members from the College of Engineering and the College of Arts and Sciences with expertise in electrical engineering, mechanical engineering, physics, chemistry, and biology.

Admission and Application Requirements

Admission Requirements. An applicant must satisfy the minimum admission requirements of the Graduate College. In addition, the applicant must hold a baccalaureate degree in engineering from an ABET-accredited program or a baccalaureate degree in physics or chemistry, and must follow the application procedures specified below. Admission is competitive and the achievement of minimum requirements does not guarantee admission.

Application Procedures. A prospective student may apply at any time and should follow the general graduate application procedure for degree-seeking students (see Applying as a Degree-Seeking Student in this catalog). The applicant must also 1) submit a statement of purpose to the graduate program coordinator, 2) have three letters of recommendation submitted directly by the references to the graduate program coordinator, and 3) arrange to have GRE General Test scores submitted by the Educational Testing Service (www.ets.org) directly to Boise State University (code R4018). The
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Degree Requirements

Students must complete at least 30 graduate credits distributed as shown in the degree requirements table. A written thesis proposal and oral presentation to the supervisory committee is required prior to the completion of 15 credits applicable to the degree requirements. Work on the thesis can only be undertaken after approval of the thesis proposal by the supervisory committee. The thesis must constitute an original contribution to knowledge in materials science and engineering and must be successfully defended at a final oral examination. All work directly related to the thesis must be represented by at least 6 credits of MSE 593, PHYS 593, or CHEM 593.

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<tr>
<td><strong>Course Number and Title</strong></td>
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<tr>
<td><strong>Required Courses</strong></td>
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<tr>
<td>MSE 505 Bonding and Structure of Materials</td>
</tr>
<tr>
<td>MSE 508 Solid State Thermodynamics</td>
</tr>
<tr>
<td>MSE 518 Phase Transformations and Kinetics</td>
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<tr>
<td>PHYS 515 Solid State Physics</td>
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<tr>
<td>PHYS 523 Physical Methods of Materials Characterization</td>
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<tr>
<td><strong>Other Graduate Courses</strong></td>
</tr>
<tr>
<td>Graduate courses in materials science and engineering or related field; all courses to be selected with student input and approved by the supervisory committee.</td>
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<tr>
<td><strong>Thesis</strong></td>
</tr>
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<td>MSE 593 Thesis OR PHYS 593 Thesis OR CHEM 593 Thesis</td>
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<td><strong>TOTAL</strong></td>
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Special Rule on Transfer Credit. The normal transfer credit policies of the Graduate College hold except that up to 15 transfer credits earned in combination at the University of Idaho and Idaho State University may be applied to either degree program (M.S. MSE or M.Engr. MSE) with the approval of the supervisory committee.
Interdisciplinary Programs
Master of Science in Materials Science and Engineering

Course Offerings

CHEM—CHEMISTRY

CHEM 501 ADVANCED INORGANIC CHEMISTRY (3-0-3)(F). Atomic structure, molecular structure using valence bond and molecular orbital theories, elementary group theory, transition metal coordination chemistry, acids and bases, descriptive transition and nontransition metal chemistry. PREREQ: CHEM 322 or PERM/INST.

ECE—ELECTRICAL AND COMPUTER ENGINEERING

ECE 510 ELECTRICAL AND COMPUTER ENGINEERING

ECE 540 INTRO TO INTEGRATED CIRCUIT AND MEMS PROCESSING (3-0-3)(F). Fundamentals of integrated circuit and micro electromechanical systems (MEMS) fabrication technology; semiconductor substrates; theory of unit processes such as diffusion, oxidation, ion implantation, rapid thermal processing, photolithography, wet etching and cleaning, dry etching, thin-film deposition; chemical mechanical polishing; process integration; metrology; statistical process control; TCAD. COREQ: ECE 540L. PREREQ: ECE 523 or PERM/INST.

ECE 540L INTRO TO INTEGRATED CIRCUIT AND MEMS PROCESSING LAB (0-3-1)(F). Seminar lab experience accompanying ECE 540 using a hands-on approach to semiconductor processing. PREREQ: CHEM 322 or ENGR 245 or CHEM 112.


ECE 542L PHOTO LITHOGRAPHY LAB (0-3-1)(F). Seminar lab experience accompanying ECE 542, utilizing a projection-printing wafer stepper, photoresist wafer track, SEM, and optical metrology equipment. Use of TCAD lithography simulation software. PREREQ: ECE 342. COREQ: ECE 542.

ECE 545 INTRODUCTORY QUANTUM MECHANICS (3-0-3)(F). Introduction to quantum mechanics and its applications to modern electronic devices. PREREQ: ECE 523 or ENGR 320 or MSE 308 or PHYS 432.

ECE 546 ADVANCED TRANSMISSION ELECTRON MICROSCOPY (1-3-2)(F). In-depth understanding of transmission electron microscopy (TEM) and its applications to modern materials science and engineering. PREREQ: CHEM 322 or ENGR 245.

ECE 547 MICROELECTRONIC PACKAGING MATERIALS (3-0-3)(F). Theory of materials science, corrosion, reliability physics. PREREQ: ECE 545.

ECE—ELECTRICAL AND COMPUTER ENGINEERING

ECE 548 ADVANCED TRANSMISSION ELECTRON MICROSCOPY (3-0-3)(F). In-depth understanding of the transmission electron microscope (TEM), electron diffraction, imaging techniques, analytical techniques, and high-resolution electron microscopy (HREM). Students are required to have an approved project that utilizes the TEM. PREREQ: ECE 541 or ECE 542.

ECE 549 ADVANCED TOPICS IN MATERIALS SCIENCE AND ENGINEERING (3-0-3)(F/S)(On demand). Advanced topics in materials science and engineering such as defects in solids, physics of thin films, nanomaterials, optoelectronics, computational materials science, corrosion, reliability physics. PREREQ: ECE 545.


ECE 551 SEMICONDUCTOR MATERIALS (3-0-3)(F). Examination of the properties of semiconductors including electronic structure, free carrier statistics, optical properties, crystallography, and defects. Study of thermodynamic properties as related to lattice vibrations and diffusion. PREREQ: ENGR 245.

ECE 552 MECHANICAL PROPERTIES OF MATERIALS (3-0-3)(F). Study of deformation and fracture in engineering materials, including elastic and plastic deformations; dislocation theory; alloy hardening and creep deformation; fracture mechanisms; linear elastic and nonlinear fracture mechanics; toughening of metals, ceramics, and composites; environmentally assisted failure. PREREQ: ENGR 245.

ECE 553 SEMICONDUCTOR DEVICES (3-0-3)(F). Theory of semiconductors and their devices, including bipolar, field effect, and other devices. PREREQ: ECE 510 or ECE 545.


ECE 555 ADVANCED TOPICS IN MATERIALS SCIENCE AND ENGINEERING (3-0-3)(F/S)(On demand). Advanced topics in materials science and engineering such as defects in solids, physics of thin films, nanomaterials, optoelectronics, computational materials science, corrosion, reliability physics. PREREQ: ECE 545.


ECE 557 BIOMATERIALS (3-0-3)(F). Theory of biomaterials science. Medical and biological materials and their applications. Selection, properties, characterization, design and testing of materials used by or in living systems. May be taken for BIOL, ME or MSE credit, but only from one department. PREREQ: ENGR 245 or CHEM 112.

ECE 558 BIOMATERIALS AND BIOENGINEERING (3-0-3)(F). Theory of environmental degradation of metals, ceramics, polymers and biomaterials. The scientific principles of materials degradation with emphasis on material interactions within a living organism (in vivo). PREREQ: CHEM 112 or ENGR 245.

PHYS—PHYSICS

PHYS 501 ADVANCED PHYSICS (3-0-3)(F). Advanced topics in physics, including quantum mechanics, special relativity, statistical mechanics, and thermodynamics. PREREQ: PHYS 301.

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PHYS 503 PHYSICS OF MATERIALS (3-0-3)(F). Physics of materials, including crystallography, elasticity, plasticity, phase transitions, and thermal expansion. PREREQ: PHYS 301.

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