

## **Approved Courses for MS in Materials Science & Engineering**

(Updated August 2023)

The MS in MSE requires a total of 30 credit hours of graduate level (400 level or above) work in engineering, mathematics, or the sciences. The credits must meet the following conditions:

- At least 15 of the 30 required credits must be MEMS courses.
- For students pursuing the **Course Option**, coursework must include at least 18 credits (6 courses) from the list of Materials Science and Engineering electives below.
- For students pursuing the **Thesis Option**, at least 6 credits must be Masters Research (MEMS 599), and at least 24 credits must be coursework. This coursework must include at least 12 credits (4 courses) from the list of Materials Science and Engineering electives below.
- Of the 30 credits required, no more than 3 courses (9 credits) may be at the 400 level. These courses should be selected from the list of Materials Science and Engineering electives below; a maximum of one 400-level course (3 credits) can be used as a free technical elective. The 400-level courses cannot be required courses for the student's undergraduate degree.
- All MS students must complete 3 credits (1 course) of advanced mathematics at the graduate level selected from the list at the end of this document.
- All MS students are permitted to count a maximum of 3 credits of Independent Study (MEMS 400/500) towards the required 30 credits. These are counted as free technical elective credits.

Additionally, each semester all full-time MS students must enroll in either the department's Graduate Seminar (MEMS 501) or the Graduate Seminar offered by the Institute of Materials Science and Engineering (IMSE 501). These are zero-unit, pass-fail courses.

### **MATERIALS SCIENCE AND ENGINEERING ELECTIVES**

#### *Broad Topics:*

CHEM 5620 Solid State & Materials Chemistry<sup>1</sup>  
EECE 502 Advanced Thermodynamics in EECE  
EECE 576 Chemical Kinetics and Catalysis  
MEMS 5102 Materials Selection in Design  
MEMS 5610 Quantitative Materials Science & Engineering<sup>2</sup>  
MEMS 5612 Atomistic Modeling of Materials  
MEMS 5616 Defects in Materials  
MEMS 5619 Thermodynamics of Materials  
PHYS 463 Statistical Mechanics and Thermodynamics  
PHYS 537 Kinetics of Materials

#### *Biomaterials/Soft Matter:*

BME 479 Biofabrication & Medical Devices  
BME 523 Biomaterials Science  
BME 532 Physics of Biopolymers  
CHEM 452 Synthetic Polymer Chemistry  
CHEM 462 Synthetic Polymer Chemistry Laboratory  
IMSE 510 Special Topics in Biomaterials: Structures and Properties of Endogenous Biological Materials  
MEMS 5606 Soft Nanomaterials  
MEMS 5607 Introduction to Polymer Blends & Composites  
MEMS 5608 Introduction to Polymer Science & Engineering

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<sup>1</sup> Chem 5620 is co-taught with Chem 465. Chem 5620 is the graduate level version; students who already have credit for Chem 465 may not be able to take Chem 5620 for credit. Please discuss with the MS advisor.

<sup>2</sup> MEMS 5610 may be counted as EITHER a Materials Science and Engineering elective OR an advanced mathematics course.

MEMS 5613 Biomaterials Processing  
MEMS 5614 Polymeric Materials Synthesis and Modification

*Electronic/Optical Materials & Devices:*

CHEM 543 Physical Properties of Quantum Nanostructures  
ESE 436 Semiconductor Devices  
ESE 531 Nano & Micro Photonics<sup>1</sup>  
ESE 536 Introduction to Quantum Optics  
MEMS 463 Nanotechnology Concepts and Applications  
MEMS 5617 Advanced Study of Solid-State Electronics  
MEMS 5618 Electronic Behavior of Materials  
MEMS 5801 Micro-Electro-Mechanical Systems I  
PHYS 472 Solid State Physics  
PHYS 549 Solid State Physics I  
PHYS 550 Solid State Physics II

*Energy and Environmental Technologies:*

CHEM 426 Inorganic Electrochemistry and Photochemistry<sup>1</sup>  
EECE 504 Aerosol Science & Technology  
EECE 505 Aquatic Chemistry  
EECE 534 Environmental Nanochemistry  
EECE 574 Electrochemical Engineering  
EPS 567 Planetary Materials

*Structural Materials:*

MEMS 4101 Manufacturing Processes  
MEMS 5506 Experimental Methods in Solid Mechanics  
MEMS 5507 Fatigue and Fracture Analysis  
MEMS 5601 Mechanical Behavior of Materials  
MEMS 5605 Mechanical Behavior of Composites  
MEMS 5615 Metallurgy and Design of Alloys

**ADVANCED MATHEMATICS REQUIREMENT**

The following courses may be used to fulfill the graduate-level math requirement:

Any course taught by the Math department at the 400 level or higher.

EECE 503 Mathematical Methods in EECE  
ESE 405 Reliability and Quality Control  
ESE 415 Optimization  
ESE 501-502 Mathematics of Modern Engineering I, II  
ESE 517 Partial Differential Equations  
ESE 520 Probability and Stochastic Processes  
MEMS 5001 Optimization Methods in Engineering  
MEMS 5301 Nonlinear Vibrations  
MEMS 5403 Conduction and Convection Heat Transfer  
MEMS 5501 Mechanics of Continua  
MEMS 5610 Quantitative Materials Science and Engineering<sup>2</sup>  
Physics 501-502 Theoretical Physics (must know quantum mechanics)  
Physics 503-504 Advanced Math Methods for Physicists and Engineers