

Ph.D. in Materials Science and Engineering

The program is offered in two options, the Materials Science option (p. 1) and the Materials Engineering option (<http://catalog.njit.edu/graduate/newark-college-engineering/chemical-materials-engineering/materials-science-engineering-phd/>). These options are administered by the JHCSLA (Jordan Hu College of Science and Liberal Arts) and NCE (Newark College of Engineering) colleges, respectively. A joint committee involving JHCSLA and NCE faculty will be in charge of overseeing this program.

Materials Science Option

Administered by Department of Physics, JHCSLA

Degree Requirements

Students with an appropriate master's degree in materials science or related field, physics, chemistry or engineering, are required to complete a course work of 12 credits in 700 level courses beyond the master's degree. Students must also complete sufficient credits of dissertation research (MTSE 790 (<http://catalog.njit.edu/search/?P=MTSE%20790>)) and meet the milestone deadlines, as specified by the Office of Graduate Studies. Specific course selection, the track and dissertation topics are approved by the program advisor on an individual basis.

Students entering with bachelor's degrees are required to complete a course work of 36 credits. Students must also complete sufficient credits of dissertation research (MTSE 790 (<http://catalog.njit.edu/search/?P=MTSE%20790>)) and meet the milestone deadlines, as specified by the Office of Graduate Studies. For the course work, the required courses for the M.S. in Materials Science are mandatory; no less than 12 credits must be at the 700 level and none at the 500 level. Specific course selection, the track, and dissertation topics are approved by the program advisor on an individual basis.

Seminar

All students must enroll each semester in MTSE 791 (<http://catalog.njit.edu/search/?P=MTSE%20791>) Graduate Seminar (0 credit), unless the requirement is waived by the Director for Materials Science Option of Materials Science and Engineering program.

Tracks

The range of possible tracks and courses is broad and is not limited to the tracks and courses listed here. Students should consult the graduate advisor in designing the track and course requirements of the track.

Cross-listed courses

Any cross-listed courses will not be offered simultaneously, but only one of the two will be offered at a time.

Ph.D. in Materials Science and Engineering – Materials Science option (entering with master's degree)

Code	Title	Credits
700-level courses in a chosen track		12
MTSE 791	Graduate Seminar	
Total Credits		12

Ph.D. in Materials Science and Engineering – Materials Science option (entering with bachelor's degree)

Code	Title	Credits
Required Courses (2 common and 2 selective courses)		
MTSE 601 or MTEN 610	Fundamentals of Engineering Materials Found of Materials Sci & Engr	3
MTSE 602 or MTEN 612	Thermodynamics of Materials Thermodynamics of Materials	3
Select two of the following four courses		9
MTSE 603	Intro to Phys Prin of Material	
MTSE 688	Mathematical and Statistical Methods in Materials Science	
MTSE 765	Science and Technology of Thin Films	
CHEM 748 or MTEN 712	Nanomaterials Nanomaterials	

Remaining courses

600- or 700-level courses in a chosen track

700-level courses in a chosen track

MTSE 791	Graduate Seminar	0
Total Credits of Course Work		36

* No less than 12 credits must be at the 700 level, including credits from the required courses.

Tracks

Electronic and Photonic Materials Tracks

Code	Title	Credits
MTSE 603	Intro to Phys Prin of Material	3
MTSE 688	Mathematical and Statistical Methods in Materials Science	3
MTSE 765	Science and Technology of Thin Films	3
CHEM 748	Nanomaterials	3
or MTEN 712	Nanomaterials	
MTSE 610	Mechanical Properties of Materials	3
MTSE 655	Diffusion and Solid State Kinetics	3
or MTEN 611	Diffusion & Solid State Kineti	
MTSE 681	Composite Materials	3
MTSE 719	Physical Principles of Characterization of Solids	3
MTSE 719	Physical Principles of Characterization of Solids	3
MTSE 724	Transport of Electrons and Phonons in Solids	3
PHYS 661	Solid-State Physics	3
PHYS 682	Introduction To MemS	3
PHYS 687	Physics of Materials	3
PHYS 789	Physics of Advanced Semiconductor Device Processing	3
PHYS 611	Adv Classical Mechanics	3
PHYS 621	Classical Electrodynamics	3
PHYS 641	Statistical Mechanics	3
R755 631		
PHYS 731	Quantum Mechanics II	3
CHEM 610	Advanced Inorganic Chemistry	3
CHEM 658	Advanced Physical Chemistry	3
CHEM 737	Applications of Computational Chemistry and Molecular Modeling	3
CHEM 764	Advanced Analytical Chemistry	3
CHE 702	Selected Topics in Chemical Engineering II	3
ECE 625	Fiber and Integrated Optics	3
ECE 626	Optoelectronics - Nonlinear Modulators for Optical Communication	3
ECE 657	Semiconductor Devices	3
ECE 658	VLSI Design I	3
ECE 659	Fabrication Principles of Electronic and Optoelectronic Devices	3
ECE 739	Laser Systems	3

Particulate and Nano Materials Track

Code	Title	Credits
MTSE 603	Intro to Phys Prin of Material	3
MTSE 688	Mathematical and Statistical Methods in Materials Science	3
MTSE 765	Science and Technology of Thin Films	3
CHEM 748	Nanomaterials	3
or MTEN 712	Nanomaterials	
MTSE 610	Mechanical Properties of Materials	3
MTSE 655	Diffusion and Solid State Kinetics	3
or MTEN 611	Diffusion & Solid State Kineti	
MTSE 681	Composite Materials	3

MTSE 719	Physical Principles of Characterization of Solids	3
CHEM 605	Advanced Organic Chemistry I: Structure	3
CHEM 610	Advanced Inorganic Chemistry	3
CHEM 658	Advanced Physical Chemistry	3
CHEM 673	Biochemistry	3
CHEM 737	Applications of Computational Chemistry and Molecular Modeling	3
CHEM 764	Advanced Analytical Chemistry	3
BME 669	Engineering Physiology	3
BME 672	Biomaterials	3
PHYS 661	Solid-State Physics	3
PHYS 682	Introduction To MemS	3
PHYS 687	Physics of Materials	3
PHYS 611	Adv Classical Mechanics	3
PHYS 621	Classical Electrodynamics	3
PHYS 641	Statistical Mechanics	3
R755 631		
PHYS 731	Quantum Mechanics II	3
ME 676	Applied Plasticity	3
ME 678	Engineering Design of Plastic Products	3

Mathematical and Computational Materials Science Track

Code	Title	Credits
MTSE 603	Intro to Phys Prin of Material	3
MTSE 688	Mathematical and Statistical Methods in Materials Science	3
MATH 611	Numerical Methods for Computation	3
MATH 613	Advanced Applied Mathematics I: Modeling	3
MATH 666	Simulation for Stochastic Systems	3
MATH 671	Asymptotic Methods I	3
MATH 675	Partial Differential Equations	3
MATH 677	Calculus of Variations	3
MATH 689	Advanced Applied Mathematics II: Ordinary Differential Equations	3
MATH 690	Advanced Applied Mathematics III: Partial Differential Equations	3
MATH 712	Numerical Methods II	3
MATH 713	Advanced Scientific Computing: Multi-Dimensional Finite-Difference Schemes and Spectral Methods	3
MATH 722	Wave Propagation	3
MATH 767	Fast Numerical Algorithms	3
PHYS 661	Solid-State Physics	3
PHYS 611	Adv Classical Mechanics	3
PHYS 621	Classical Electrodynamics	3
PHYS 641	Statistical Mechanics	3
R755 631		
PHYS 731	Quantum Mechanics II	3
CHEM 737	Applications of Computational Chemistry and Molecular Modeling	3
MTSE 765	Science and Technology of Thin Films	3
CHEM 748	Nanomaterials	3
or MTEN 712	Nanomaterials	

Qualifying Examination

The student must pass a written and an oral qualifying examination. The written qualifying exam given every summer is administered to test general academic preparation and competence in the research of Materials Science. Within one year after passing the written qualifying exam, the student is required to pass the oral qualifying exam to achieve Ph.D. candidacy, in which the potential Ph.D. candidate presents a preliminary research proposal for approval by the dissertation committee. The student will be allowed two attempts to pass the written or oral qualifying exam.

Students take written qualifying exams on the following common required courses.

Code	Title	Credits
MTSE 601 or MTEN 610	Fundamentals of Engineering Materials Found of Materials Sci & Engr	3
MTSE 602 or MTEN 612	Thermodynamics of Materials Thermodynamics of Materials	3

Formation of Dissertation Committee

Within one year of passing the written qualifying examination, doctoral students must form a five-member dissertation committee that meets the approval of the graduate program director for Materials Science Option of Materials Science and Engineering. The committee must include the dissertation advisor, three additional faculty members from the program, and at least one member from outside the program or NJIT.

Dissertation and Defense

An oral presentation and public defense of the doctoral dissertation is required.