Materials Science and Engineering, Ph.D.

Curriculum in Doctor of Philosophy – Materials Science and Engineering

A candidate for the Ph.D. degree with a major in materials science and engineering must comply with the rules and regulations as outlined in the WVU Graduate Catalog and the specific requirements of the Statler College and the Department of Mechanical, Materials, and Aerospace Engineering (MMAE).

Program Requirements

The doctor of philosophy degree with a major in materials science and engineering is administered through the college’s interdisciplinary Ph.D. program. The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of materials science and engineering.

All Ph.D. degree candidates are required to perform research and follow a planned program of study. The student’s research advisor, in conjunction with the student's Advising and Examining Committee (AEC) will be responsible for determining the plan of study appropriate to the student's needs. The underlying principle of the planned program is to provide the students with the necessary support to complete their degree and prepare them for their career.

PUBLICATION REQUIREMENT FOR PHD STUDENTS

Prior to scheduling the dissertation defense, Ph.D. students are required to provide written documentation that they have received formal proof of submission of either:

a.) At least one manuscript, generally co-authored with their research supervisor and about some portion of their PhD dissertation research, to an archival journal for publication, or

b.) At least one patent disclosure, also generally about some portion of their PhD dissertation research.

This publication requirement will have to be satisfied prior to scheduling the defense of the Ph.D. Dissertation.

Curriculum Requirements (BS-PhD Pathway)

<table>
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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<td>A minimum GPA of 3.0 is required in all courses.</td>
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**Coursework Requirements**

- **MAE 583** Thermodynamics and Kinetics of Materials
- **MAE 580** Crystallography and Crystals
- **MAE 649** Microscopy of Materials

Select courses from the following list:

- **CHE 531** Mathematical Methods in Chemical Engineering
- **CHE 565** Corrosion Engineering
- **CHE 625** Chemical Reaction Engineering
- **CHE 615** Transport Phenomena
- **CHE 720** Applied Statistical and Molecular Thermodynamics
- **CHE 726** Catalysis
- **CHEM 514** Mass Spectrometry Principles and Practices
- **CHEM 521** Organometallic Chemistry
- **CHEM 547** Chemical Crystallography
- **CHEM 713** Electrochemistry and Instrumentation
- **CHEM 723** Physical Methods in Inorganic Chemistry
- **EE 528** Biomedical Microdevices
- **EE 550** Advanced Semiconductor Electronics
- **EE 551** Linear Integrated Circuits
- **EE 650** Optoelectronics
- **PHYS 771** Advanced Solid State Physics
- **PHYS 772** Semiconductor Physics
- **PHYS 773** Collective Phenomena in Solids
- **PHYS 774** Optical Properties of Solids

PUBLICATION REQUIREMENT FOR PHD STUDENTS

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b.) At least one patent disclosure, also generally about some portion of their PhD dissertation research.

This publication requirement will have to be satisfied prior to scheduling the defense of the Ph.D. Dissertation.
MAE 528 Introduction to Fuel Cell Technology
MAE 543 Advanced Mechanics of Materials
MAE 640 Continuum Mechanics
MAE 643 Inelastic Behavior of Engineering Materials
MAE 644 Fracture Mechanics
MAE 645 Energy Methods in Applied Mechanics
MAE 646 Advanced Mechanics of Composite Materials
MAE 648 Experimental Stress Analysis
& 648L and Experimental Stress Analysis Laboratory
MAE 687 Materials Engineering

Any BIOM, BMEG, CE, CHE, CHEM, CPE, CS, EE, IENG, IH&S, MAE, MATH, MINE, PNGE, PHYS, SAFM, SENG, EXPH 583, or STAT courses 500-795, as approved by the student’s AEC.

Materials Science and Engineering Seminar 2
MAE 686 Materials Science and Engineering Seminar
Research 24
MAE 797 Research

Milestones
Plan of Study
Qualifying Exam
Candidacy Exam
Publication Requirement
Final Exam
Dissertation

Total Hours 56

* Students who do not hold a baccalaureate degree in materials science and engineering are required to take a set of undergraduate engineering course above and beyond the minimum coursework requirements

Curriculum Requirements (MS-PhD Pathway)

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<td>MAE 580</td>
<td>Crystallography and Crystals</td>
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<tr>
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<td>Thermodynamics and Kinetics of Materials</td>
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<td>Microscopy of Materials</td>
<td>3</td>
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MAE 643  Inelastic Behavior of Engineering Materials
MAE 644  Fracture Mechanics
MAE 645  Energy Methods in Applied Mechanics
MAE 646  Advanced Mechanics of Composite Materials
MAE 648  Experimental Stress Analysis and Experimental Stress Analysis Laboratory
& 648L
MAE 687  Materials Engineering

Any BIOM, BMEG, CE, CHE, CHEM, CPE, CS, EE, IENG, IH&S, MAE, MATH, MINE, PNGE, PHYS, SAFM, SENG, EXPH 583, or STAT courses 500-795, as approved by the student's AEC.

Materials Science and Engineering Seminar 2
MAE 686  Materials Science and Engineering Seminar
Research 24
MAE 797  Research

Milestones
Plan of Study
Qualifying Exam
Candidacy Exam
Publication Requirement
Final Exam
Dissertation

Total Hours 44

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Examinations

QUALIFYING EXAM
All Ph.D. students must take and pass a written qualifying examination. The qualifying examination is given no later than the end of the third semester of enrollment in their Ph.D. program. This examination is designed to assess the basic competency of students to determine whether or not they have sufficient knowledge of the discipline to undertake independent research. The qualifying examination is administered by the Department of Mechanical, Materials, and Aerospace Engineering following the format specifically set forth for the MS&E Ph.D. degree program.

CANDIDACY EXAMINATION
In order to be admitted to candidacy, the student must pass a candidacy exam, which is designed to evaluate the student's overall ability to engage in high-level research. After passing the qualifying examination, the student must submit to the AEC a written research proposal of his/her planned dissertation work and successfully defend it in an oral examination. The research proposal must be approved by the student’s AEC. A student who has successfully completed all coursework, passed the qualifying examination, successfully defended the research proposal, and receives the college’s approval becomes a candidate for a Ph.D. degree. Thereafter, the student will officially be engaged in dissertation research.

FINAL EXAMINATION
At the completion of the dissertation research, candidates must prepare a dissertation and pass the final oral examination (defense) administered by their AEC. This examination is open to the public and, in order to evaluate critically the student’s competency, may include testing on material in related fields, as deemed necessary by the AEC.

Major Learning Outcomes
DOCTOR OF PHILOSOPHY (PHD)
Upon graduation with a Ph.D. degree from the Statler College of Engineering and Mineral Resources students will have:
• Ability to initiate research ideas in order to solve specific problems and to write research proposals on these ideas
• Have an expert-level understanding of the advanced principles of their fields of study
• Furthered a novel research idea which has contributed to the state of the art in their specific areas of expertise
• Ability to plan original research projects, to perform laboratory or field based experimental tasks, generate data from those tasks, and draw conclusions based on sound scientific and engineering principles
• Ability to develop innovative research in order to advance the frontiers of knowledge and secure sponsored research
• Ability to write technical articles for dissemination through peer-reviewed, refereed journals or other venues
• Ability to make oral and poster presentations at technical meetings
• Understanding of professional and ethical responsibilities in the practice of their profession to contribute to the well-being of society and to the advancement of their profession
• Demonstrated initiative in research planning and management, including safety and environmental issues
• Technical preparation for and an awareness of the need for life-long learning and continuing education