Degree Offered

- Master of Science

*For Ph.D. option, see area of emphasis under Ph.D. in Plant and Soil Sciences

Admissions

M.S. APPLIED AND ENVIRONMENTAL MICROBIOLOGY

In order for a student to be admitted to the program, the applicant normally must fulfill the following admission criteria to be considered:

- Possess a baccalaureate degree.
- Have a minimum undergraduate grade point average of 2.75 (3.0 for acceptance as a regular graduate student).
- Have an adequate academic aptitude at the graduate level as measured by the Graduate Record Examination (GRE) or other tests/evidence.
- Provide three letters of reference from persons acquainted with the applicant’s professional work, experience, or academic background.
- Submit a written statement of approximately 500 words indicating the applicant’s goals and objectives relative to receiving a graduate degree.

International students have the additional requirement to submit a minimum score of 213 on the computer based TOEFL examination if their native language is not English. Interviews are encouraged but not required.

ACCELERATED B.S./M.S. APPLIED AND ENVIRONMENTAL MICROBIOLOGY

The ABM-AEM program will directly admit first year students (early admission) or admit students after the completion of at least 60 credit hours.

EARLY ADMISSION

For early admission, entering WVU first-year students must have a minimum high school GPA of 3.0 and SAT or ACT test scores at or above the 70th percentile. Early admitted students must meet the standards described below for regular admission to continue in the ABM-AEM program after the completion of 60 credits. Students must provide a personal statement of no less than 500 words identifying the applicant's goals and objectives in obtaining the ABM-AEM degree and three letters of reference, at least two of which are required from persons familiar with the applicant's academic performance including those serving in an advisory role such as teachers, school administrators, or a guidance counselor.

REGULAR ADMISSION

Only currently enrolled WVU students may be considered for regular admission to the program. Transfer students must complete at least 24 credit hours as degree-seeking students at WVU before applying to the program. ABM-AEM is not available to students seeking a second (or subsequent) bachelor's degree. Regular admission may not be any earlier than the semester in which an undergraduate student is expected to complete 60 credits or any later than the semester after which the student needs two additional semesters to complete the bachelor's degree. The minimum standard for regular admission is a cumulative undergraduate GPA of 3.0, with no provisional admissions allowed. Students must provide a personal statement of no less than 500 words identifying the applicant's goals and objectives in obtaining the ABM-AEM degree and three letters of reference, at least two of which are required from persons familiar with the applicant's academic performance including those serving in an advisory role such as teachers, school administrators, or a guidance counselor.

A candidate for the M.S. degree in Applied and Environmental Microbiology must meet all University, College, Division, and Program requirements as outlined in the WVU Graduate Catalog.

Program Requirements

All M.S. degree candidates are required to follow a planned program of study. The student develops the plan of study during their first year in the program in conjunction with the graduate committee. The plan must be approved by the Director of the Division and the Associate Dean for Academic Affairs of the Davis College.

Thesis Option:

A minimum cumulative GPA of 3.0 is required in all courses applied toward degree requirements.

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 511</td>
<td>Statistical Methods 1</td>
</tr>
</tbody>
</table>
Select one of the following:  

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 601</td>
<td>Applied Biostatistics 1</td>
</tr>
<tr>
<td>&amp; BIOS 602</td>
<td>and Applied Biostatistics Lab</td>
</tr>
</tbody>
</table>

Seminar  
AGRN 796 Graduate Seminar

Research  
AEM 797 Research

Discipline-Oriented Coursework  
(AEM, PPTH, AGRN, ENTO, AGBI, BIOL, GEN, HORT, MICB, IMMB, PLSC)

Total Hours  
30

Non-Thesis Option:  
A minimum cumulative GPA of 3.0 is required in all courses applied toward degree requirements.

Select one of the following:  

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 511</td>
<td>Statistical Methods 1</td>
</tr>
<tr>
<td>STAT 512</td>
<td>Statistical Methods 2</td>
</tr>
<tr>
<td>BIOS 601</td>
<td>Applied Biostatistics 1</td>
</tr>
<tr>
<td>&amp; BIOS 602</td>
<td>and Applied Biostatistics Lab</td>
</tr>
<tr>
<td>BIOS 603</td>
<td>Applied Biostatistics 2</td>
</tr>
<tr>
<td>&amp; BIOS 604</td>
<td>and Applied Biostatistics 3</td>
</tr>
</tbody>
</table>

Graduate Chemistry/Biochemistry Course  
AGBI 610 General Biochemistry  
AGBI 612 General Biochemistry  
AGRN 516 Soil Chemistry

Teaching Practicum  
AEM 790 Teaching Practicum

Discipline-Oriented Coursework  
(AEM, PPTH, AGRN, ENTO, AGBI, BIOL, GEN, HORT, MICB, IMMB, PLSC)

Total Hours  
24

- Students must complete a minimum of 30 total hours, of which at least 24 hours must be coursework other than research, thesis, project, internship, etc. credits.

Accelerated Program Requirements  
A minimum GPA of 3.0 is required.

Choose from the following courses:  

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEM 445</td>
<td>Food Microbiology</td>
</tr>
<tr>
<td>or AEM 545</td>
<td>Food Microbiology</td>
</tr>
<tr>
<td>AEM 593</td>
<td>Special Topics</td>
</tr>
<tr>
<td>GEN 521</td>
<td>Basic Concepts of Modern Genetics</td>
</tr>
<tr>
<td>PPTH 409</td>
<td>Nematology</td>
</tr>
<tr>
<td>or PPTH 509</td>
<td>Nematology</td>
</tr>
<tr>
<td>PPTH 503</td>
<td>Mycology</td>
</tr>
<tr>
<td>STAT 511</td>
<td>Statistical Methods 1</td>
</tr>
</tbody>
</table>
### Oral Examination

Total Hours 36

#### First Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRL 111</td>
<td>1 CHEM 116</td>
</tr>
<tr>
<td></td>
<td>&amp; 116L (GEF 8)</td>
</tr>
<tr>
<td>CHEM 115</td>
<td>4 PLSC 206</td>
</tr>
<tr>
<td>&amp; 115L (GEF 2)</td>
<td></td>
</tr>
<tr>
<td>ENGL 101 (GEF 1)</td>
<td>3 STAT 211</td>
</tr>
<tr>
<td>MATH 150 (GEF 3)</td>
<td>3 Free Electives</td>
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<tr>
<td>Free Elective</td>
<td>3</td>
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#### Second Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRN 202</td>
<td>4 AEM 341</td>
</tr>
<tr>
<td>&amp; AGRN 203</td>
<td></td>
</tr>
<tr>
<td>CHEM 233</td>
<td>4 CHEM 234</td>
</tr>
<tr>
<td>&amp; CHEM 235</td>
<td>&amp; CHEM 236</td>
</tr>
<tr>
<td>ENGL 102 (GEF 1)</td>
<td>3 GEF 5</td>
</tr>
<tr>
<td>GEF 4</td>
<td>3 Free Electives</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

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#### Third Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 101 (GEF 8)</td>
<td>4 PHYS 102 (GEF 8)</td>
</tr>
<tr>
<td>PPTH 401</td>
<td>4 Restricted Electives</td>
</tr>
<tr>
<td>Restricted Elective</td>
<td>3 GEF 7</td>
</tr>
<tr>
<td>GEF 6</td>
<td>3</td>
</tr>
</tbody>
</table>

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#### Fourth Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGBI 410</td>
<td>3 AEM 401</td>
</tr>
<tr>
<td>GEN 371</td>
<td>4 Graduate Course 3</td>
</tr>
<tr>
<td>Restricted Elective</td>
<td>3 Graduate Course 4</td>
</tr>
<tr>
<td>Graduate Course 1</td>
<td>3 Restricted Elective</td>
</tr>
<tr>
<td>Graduate Course 2</td>
<td>3</td>
</tr>
</tbody>
</table>

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#### Fifth Year

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Electives</td>
<td>12 Graduate Electives</td>
</tr>
</tbody>
</table>

12 12

Total credit hours: 144

NOTE: See Undergraduate Catalog for Bachelor's degree requirements (B.S. in Applied Environmental Microbiology, Accelerated Program).

### Major Learning Outcomes

**APPLIED AND ENVIRONMENTAL MICROBIOLOGY**

Students will acquire fundamental knowledge of applied and environmental microbiology and associated fields such as biochemistry, genetics, and biology.

Students will acquire detailed knowledge of their particular subdiscipline or research area, including the scientific literature fundamental to their discipline and the ability to stay current on scientific literature.
Students will acquire technical skills in the laboratory.

Students will develop the ability to communicate in writing and orally about scientific concepts and the results of their research.

Students will develop the ability to design, conduct, and interpret the results of experiments.

**APPLIED ENVIRONMENTAL MICROBIOLOGY COURSES**

**AEM 545. Food Microbiology.** 3 Hours.
PR: AEM 341. The relationships of micro-organisms to food-borne illness and intoxications, microbial food quality, food spoilage, food preservation and bio-processing. The emerging food preservation technologies and predictive microbiology will be introduced.

**AEM 549. Food Microbiology Lab.** 1 Hour.
PR: AEM 545. Laboratory training in methods used in microbiological examination of foods. This laboratory will provide hands-on experience for students who take or have taken AEM 545.

**AEM 591. Advanced Topics.** 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

**AEM 592. Directed Study.** 1-6 Hours.
Directed study, reading, and/or research.

**AEM 593. Special Topics.** 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

**AEM 594. Seminar.** 1-6 Hours.
Special seminars arranged for advanced graduate students.

**AEM 595. Independent Study.** 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

**AEM 748. Sanitary Microbiology.** 3 Hours.
PR: AEM 341 or Consent. Microbiology and health hazards associated with food handling, water treatment, and sanitary waste disposal.

**AEM 750. Current Concepts in Microbial Ecology.** 1 Hour.
Emphasis on reading, criticism, and discussion of recent journal articles from the primary literature in microbial ecology/environmental microbiology.

**AEM 790. Teaching Practicum.** 1-3 Hours.
PR: Consent. Supervised practice in college teaching of applied and environmental microbiology. NOTE: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

**AEM 792. Directed Study.** 1-6 Hours.
Directed study, reading and/or research.

**AEM 795. Independent Study.** 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

**PLANT PATHOLOGY COURSES**

**PPTH 501. Diseases of Economic Plants.** 3 Hours.
2 Hr. in summer. PR: PPT 401 or 503 or consent. Recognition, cause, and control of diseases of economic plants. (Sem. 1--Diseases of vegetable crops and of tree and small fruits; Sem. 2--Diseases of ornamental plants and field and forage crops; S--Diseases of forest trees. Students may register for 1-3 Hrs. in fall and spring and 2 Hr. in summer until 8 hours of credit are accumulated).

**PPTH 503. Mycology.** 4 Hours.
Lectures and field and laboratory studies of parasitic and saprophytic fungi.

**PPTH 509. Nematology.** 3 Hours.
(Primarily for graduate students majoring in the agricultural sciences or biology.) Nematode taxonomy, binomics, and control, with particular emphasis on plant parasitic forms.

**PPTH 591. Advanced Topics.** 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

**PPTH 593. Special Topics.** 1-6 Hours.

**PPTH 595. Independent Study.** 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.
PPTH 697. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

PPTH 730. Physiology of the Fungi. 4 Hours.
PR: Organic chemistry, mycology, and bacteriology, or Consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environmental, and other biotic factors.

PPTH 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in the college teaching of plant pathology. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.)

PPTH 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PPTH 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

PPTH 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PPTH 794. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

PPTH 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

PPTH 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

PPTH 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

PPTH 798. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of students reports (698), or dissertations (798). Grading is normal.

PPTH 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use of the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is S/U; coloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirements of registration in the semester in which graduation occurs.

PLANT SCIENCE COURSES

PLSC 547. Applied Wetlands Ecology and Management. 3 Hours.
The management and ecology of wetland vegetation, soils, hydrology, and wildlife. (Cross listed as WMAN 547 and CE 547.)

PLSC 550. Grants and Grantsmanship. 2 Hours.
A course covering all steps of grant preparation, application, submission and review process.

PLSC 553. Organic Crop Production. 3 Hours.
PR: PLSC 206 and AGRN 202 and AGRN 203 or consent. Principles, practices, history, philosophy and economics of organic farming and gardening. Crop/livestock systems, national and international research on organic production. (Students may not receive credit for both PLSC 453 and PLSC 553).

PLSC 560. Plant Biochemistry. 3 Hours.
PR: (CHEM 231 or (CHEM 233 and CHEM 234)) and BIOL 219 or consent. Study of the biochemical processes and biosynthetic pathways leading to the formation of desirable plant products such as those used in food, feed, fiber, fuel and medicinal applications. (Credit cannot be received for both PLSC 460 and PLSC 560).

PLSC 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PLSC 592. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

PLSC 593. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.
PLSC 595. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

PLSC 692. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

PLSC 693. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

PLSC 697. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading will be S/U.).

PLSC 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of plant science. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

PLSC 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

PLSC 792. Directed Study. 1-6 Hours.
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Special seminars arranged for advanced graduate students.

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PLSC 796. Graduate Seminar. 1 Hour.
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PLSC 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

PLSC 798. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

PLSC 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use of the University's facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department's 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.

PLSC P206. 4 Hours.