# Biological Science, Instructional Certification: Teacher Certification in Biological Science - Preschool through Grade 12 - Graduate

## Program Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Field Requirements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biology Requirements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 112</td>
<td>Principles of Biology I</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 113</td>
<td>Principles of Biology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 213</td>
<td>Introduction to Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 230</td>
<td>Cell and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 380</td>
<td>Genetics</td>
<td>4</td>
</tr>
<tr>
<td><strong>Collateral Chemistry Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 120</td>
<td>General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 121</td>
<td>General Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 230</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 231</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 232</td>
<td>Experimental Organic Chemistry I</td>
<td>2</td>
</tr>
<tr>
<td><strong>Collateral Mathematics Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select one of the following sequences:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 109 &amp; MATH 111</td>
<td>Statistics and Applied Precalculus</td>
<td>7-8</td>
</tr>
<tr>
<td>MATH 111</td>
<td>Applied Precalculus</td>
<td></td>
</tr>
<tr>
<td>or MATH 112 &amp; MATH 116</td>
<td>Precalculus Mathematics and Calculus A</td>
<td></td>
</tr>
<tr>
<td>MATH 122 &amp; MATH 221</td>
<td>Calculus I and II</td>
<td></td>
</tr>
<tr>
<td><strong>Collateral Physics Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 191</td>
<td>University Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 193</td>
<td>College Physics I</td>
<td></td>
</tr>
<tr>
<td>PHYS 192</td>
<td>University Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 194</td>
<td>College Physics II</td>
<td></td>
</tr>
<tr>
<td><strong>Biology Electives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 12 credits from the list (see below)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Earth Science Elective</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EAES 101</td>
<td>Planet Earth</td>
<td></td>
</tr>
<tr>
<td>EAES 105</td>
<td>Physical Geology</td>
<td></td>
</tr>
<tr>
<td>EAES 107</td>
<td>Earth and the Environment</td>
<td></td>
</tr>
<tr>
<td>EAES 240</td>
<td>Historical Geology</td>
<td></td>
</tr>
</tbody>
</table>

## Teaching Methods

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 503</td>
<td>Teaching Science in Secondary Schools</td>
<td>4</td>
</tr>
</tbody>
</table>

## Total Credits

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credits</td>
<td></td>
<td>71-72</td>
</tr>
</tbody>
</table>

## Additional Requirements for State Certification

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speech</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMST 101</td>
<td>Fundamentals of Speech: Communication Requirement</td>
<td>3</td>
</tr>
</tbody>
</table>

## **Physiology and Hygiene**

Pass the MSU Health Knowledge Test available through the Center of Pedagogy or have the Undergraduate equivalent course approved by advisor.

## Educational Psychology

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDFD 582</td>
<td>Learning Theories</td>
<td>3</td>
</tr>
<tr>
<td>or PSYC 560</td>
<td>Advanced Educational Psychology</td>
<td></td>
</tr>
</tbody>
</table>

## Graduate Professional Sequence

**Introductory Sequence**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDFD 505</td>
<td>Teaching, Democracy, and Schooling</td>
<td>3</td>
</tr>
<tr>
<td>or SASE 505</td>
<td>Teaching, Democracy, and Schooling</td>
<td></td>
</tr>
<tr>
<td>SASE 518</td>
<td>Technology Integration in the Classroom</td>
<td>1</td>
</tr>
</tbody>
</table>

**Diversity and Instructional Sequence**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDFD 509</td>
<td>Sociocultural Perspectives on Curriculum and Assessment</td>
<td>3</td>
</tr>
<tr>
<td>or SASE 509</td>
<td>Sociocultural Perspectives on Curriculum and Assessment</td>
<td></td>
</tr>
</tbody>
</table>

## **Pedagogical Sequence I**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SASE 526</td>
<td>Seminar in Inclusive Pedagogy</td>
<td>3</td>
</tr>
<tr>
<td>SASE 527</td>
<td>Clinical Practice I</td>
<td>3</td>
</tr>
</tbody>
</table>

## **Pedagogical Sequence II**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SASE 514</td>
<td>In-Service Graduate Clinical Practice II</td>
<td>6</td>
</tr>
<tr>
<td>or SASE 529</td>
<td>Clinical Practice II</td>
<td></td>
</tr>
<tr>
<td>SASE 543</td>
<td>Advanced Seminar in Inclusive Pedagogy</td>
<td>3</td>
</tr>
</tbody>
</table>

## Total Credits

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credits</td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>

1. May be completed by examination.
2. Post-BA students in the Health and Physical Education program are exempt from this course.
3. SASE 514 is for in-service teachers.

## Additional Requirements for State Certification

The following additional requirements must be met prior to student teaching. Upon admission to the program, the student's submitted transcripts are evaluated to determine if any of these requirements have been fulfilled by previous coursework. In such cases, the requirement(s) appears on the degree audit as being waived.
Biology Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 300</td>
<td>Environmental Biology and Related Controversial Issues</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 330</td>
<td>Introduction to Animal Behavior</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 350</td>
<td>Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 360</td>
<td>Introduction to Bio-Imaging</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 370</td>
<td>Principles of Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 380</td>
<td>Genetics</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 404</td>
<td>Plant and Animal Histological Techniques</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 405</td>
<td>Cell Culture</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 406</td>
<td>Scanning Electron Microscopy</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 409</td>
<td>Externship in Biological Research (Co-operative Education)</td>
<td>1-4</td>
</tr>
<tr>
<td>BIOL 410</td>
<td>Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 411</td>
<td>Introduction to Transmission Electron Microscopy</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 415</td>
<td>Population Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 417</td>
<td>Evolutionary Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 418</td>
<td>Biology Independent Research</td>
<td>1-4</td>
</tr>
<tr>
<td>BIOL 420</td>
<td>Economic Botany</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 425</td>
<td>Elementary Plant Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 426</td>
<td>New Jersey Flora</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 429</td>
<td>Herpetology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 430</td>
<td>Ornithology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 431</td>
<td>Entomology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 432</td>
<td>Medical Entomology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 433</td>
<td>Developmental Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 434</td>
<td>Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 435</td>
<td>Experimental Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 436</td>
<td>Phylogenetic Zoology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 439</td>
<td>Biology of Animal Parasites</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 440</td>
<td>Gross Mammalian Anatomy</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 441</td>
<td>Comparative Anatomy of Vertebrates</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 442</td>
<td>Human Physiology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 443</td>
<td>Vertebrate Embryology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 444</td>
<td>Cell Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 445</td>
<td>Immunology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 446</td>
<td>Endocrinology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 447</td>
<td>Fundamentals of Pharmacology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 448</td>
<td>Mammalian Microanatomy</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 450</td>
<td>Medical Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 451</td>
<td>Comparative Animal Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 457</td>
<td>Virology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 458</td>
<td>Microbial Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 460</td>
<td>Biological Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 461</td>
<td>Aquatic Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 467</td>
<td>Biology of the Fishes</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 468</td>
<td>Neurobiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 471</td>
<td>Biomedical Ethics</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 475</td>
<td>Medical Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 476</td>
<td>Biology of Cancer</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 480</td>
<td>Research Community I: Organism Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 481</td>
<td>Research Community II: Organism Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 482</td>
<td>Research Community I: Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 483</td>
<td>Research Community II: Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 484</td>
<td>Research Community I: Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 485</td>
<td>Research Community II: Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 486</td>
<td>Selected Topics in Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 487</td>
<td>Statistical Genomics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 488</td>
<td>Selected Topics in Cell and Molecular Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 489</td>
<td>Selected Topics in Organismal Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 490</td>
<td>Senior Seminar in Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 491</td>
<td>Research in Biology Literature</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 492</td>
<td>Senior Colloquium</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 493</td>
<td>Molecular Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 495</td>
<td>Selected Topics in Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 497</td>
<td>Genomics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 500</td>
<td>Introductory Molecular Cell Biology</td>
<td>1.5</td>
</tr>
<tr>
<td>BIOL 503</td>
<td>Teaching Science in Secondary Schools</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 504</td>
<td>Bacteriological Techniques in Marine Sampling</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 505</td>
<td>Experimental Cell Culture</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 510</td>
<td>Biology Pedagogy for Secondary Teachers</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 512</td>
<td>Topics in Modern Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 513</td>
<td>Instrumentation and Techniques for Biological Science</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 514</td>
<td>Graduate Seminar in Biology</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 515</td>
<td>Population Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 518</td>
<td>Strategies for Teaching College Biology</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 520</td>
<td>Plant Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 521</td>
<td>Field Studies of Flowering Plants</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 522</td>
<td>Plant Pathology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 529</td>
<td>Advanced Herpetology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 532</td>
<td>Advanced Entomology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 533</td>
<td>Advanced Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 540</td>
<td>Mammalian Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 542</td>
<td>Advanced Endocrinology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 543</td>
<td>Advances in Immunology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 544</td>
<td>Advanced Comparative Animal Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 545</td>
<td>Experimental Endocrinology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 546</td>
<td>Topics in Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 547</td>
<td>Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 548</td>
<td>Molecular Biology II</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 549</td>
<td>Topics in Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 550</td>
<td>Topics in Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 551</td>
<td>Intermediary Metabolism I</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 552</td>
<td>Biology of Lipids</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>BIOL 554</td>
<td>Microbial Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 555</td>
<td>Medical Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 556</td>
<td>Molecular Biology of Proteins</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 557</td>
<td>Virology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 558</td>
<td>Microbial Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 560</td>
<td>Molecular Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 561</td>
<td>Genomics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 562</td>
<td>Short Topics in Molecular Biology</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 563</td>
<td>Statistical Genomics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 564</td>
<td>Proteomics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 565</td>
<td>Advanced Plant Molecular Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 566</td>
<td>Bioinformatics</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 568</td>
<td>Advanced Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 570</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 571</td>
<td>Physiological Plant Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 572</td>
<td>Wetland Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 573</td>
<td>Shoreline Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 574</td>
<td>Behavioral Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 575</td>
<td>Avian Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 576</td>
<td>Biology of Extreme Habitats</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 579</td>
<td>Physiological Ecology of Animals</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 580</td>
<td>Evolutionary Mechanisms</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 586</td>
<td>Selected Advanced Topics in Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 587</td>
<td>Selected Advanced Topics in Molecular Biology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 588</td>
<td>Selected Advanced Topics in Physiology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 589</td>
<td>Selected Advanced Topics in Ecology</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 592</td>
<td>Graduate Colloquium</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 593</td>
<td>Molecular Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 594</td>
<td>Signal Transduction</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 595</td>
<td>Conservation Biology. The Preservation of Biological Diversity</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 596</td>
<td>Selected Techniques in Biology Science Education</td>
<td>1.5</td>
</tr>
<tr>
<td>BIOL 597</td>
<td>Research in Biological Literature</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 598</td>
<td>Selected Techniques in Molecular Biology</td>
<td>1.5</td>
</tr>
<tr>
<td>BIOL 599</td>
<td>Introduction to Biological Research</td>
<td>4</td>
</tr>
</tbody>
</table>