College of Science and Mathematics – Student Learning Outcomes

Degree Program Table

Program Outcomes	Undergraduate	Graduate
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Biotechnology	View Outcomes	
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Wildlife, Fisheries and Conservation	View Outcomes	

Graduate

Biological Sciences

The following outcomes describe the expected competencies for students completing the graduate Biological Sciences programs.

MA Biology

- Students will be able to understand that science is a process as well as a body of knowledge.
- Students will be able to demonstrate the importance of research by completing a scholarly project(s).
- Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.
- Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.

MS Biology

- Students will be able to understand that science is a process as well as a body of knowledge.
- Students will be able to demonstrate the importance of research by designing and conducting a scientific study.
- Students will be able to prepare, communicate and defend original research in writing and in an oral presentation.
- Students will be able to demonstrate an understanding of professional ethics in the conduct of a scientific study.
- Students will be able to acquire the skills and knowledge needed for employment or advanced graduate study in discipline related areas.

Chemistry, MS

The following outcomes describe the expected competencies for students completing the graduate Chemistry program.

- **Content Knowledge:** Demonstrate in-depth knowledge of the four-core disciplines of chemistry including: analytical, inorganic, organic, and physical

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Environmental Sciences, MS/PhD

The following outcomes describe the expected competencies for students completing the graduate Environmental Sciences program.

- Scientific Study - Students will complete a well-organized scientific study related to environmental sciences. While accomplishing this, students will be able to think critically, develop hypotheses, review the literature, design and perform experiments, analyze and interpret data (results), write and defend a thesis/dissertation proposal.
- Communication Skills - Students will develop expertise in oral and written science communication skills.
- Advanced Knowledge of the Field – Students will be able to demonstrate competency in the multi-disciplinary fields of environmental science through course work and field/laboratory studies.

Mathematics, MS/MSE

The following outcomes describe the expected competencies for students completing the graduate Mathematics program.

- **Mathematical Knowledge --ADVANCED CONTENT**
  M.S. and M.S.E Mathematics graduates should have a deep exposure to at least three areas of advanced mathematics such as real analysis, complex analysis, abstract algebra, mathematical statistics, or applied statistical linear models.
- **Mathematical Practices – ANALYTICAL PRACTICES**
  M.S. and M.S.E. Mathematics graduates should be able to think analytically and critically and formulate advanced problems, solve them, interpret their solutions, and frame generalizations.
- **Mathematical Practices – REASONING PRACTICES**
  M.S. and M.S.E Mathematics graduates should reason abstractly and achieve an advanced understanding of the nature of proof including utilizing definitions, theorems, and mathematical logic to construct proofs correctly. They should utilize appropriate mathematical terminology and symbols to communicate graduate-level mathematics clearly and effectively.
- **Mathematical Practices – COMMUNICATION PRACTICES**
  M.S. and M.S.E. Mathematics graduates should communicate advanced mathematics with clarity and effective exposition.

Molecular Biosciences, MS/PhD

The following outcomes describe the expected competencies for students completing the graduate Molecular Biosciences program.

- Students will be able to demonstrate competency in the field of advanced cellular and molecular biology through course work, experimentation in the laboratory and ability to think critically about the biological processes as well their applications in their own research.
- Students will complete a well-organized scientific study related to molecular biosciences. While accomplishing this, students will be able to think critically, develop hypotheses, review the literature, design and perform experiments, analyze and interpret data (results), write and defend a thesis/dissertation proposal.
- Students will develop expertise in oral and written science communication skills.

Undergraduate

Actuarial Science

The following outcomes describe the expected competencies for students completing the undergraduate Actuarial Science program.

- B.S. Actuarial Science students will demonstrate understanding of the concepts, corresponding theories, and applications essential to actuarial analysis (mathematics, statistics, finance, economics, and accounting).
- B.S. Actuarial Science students will identify and utilize the appropriate mathematical and statistical tools to model and solve a variety of problems often encountered in actuarial applications.
- B.S. Actuarial Science students will design and evaluate models to solve common actuary problems.
- B.S. Actuarial Science students will demonstrate proficiency in computer and statistical programming software prevalent in the actuarial industry.
- B.S. Actuarial Science students will demonstrate the ability to communicate actuarial findings effectively

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Biological Sciences, BS (Evolution, Ecology, and Organismal Biology; Pre-professional Studies and Zoology)

The following outcomes describe the expected competencies for students completing the undergraduate Biological Sciences program.

- Students will be able to identify diversity as result of evolutionary and adaptive mechanisms while recognizing the underlying genetic principles and mechanisms of these processes.
- Students will be able to distinguish biological mechanisms (for example cellular respiration; photosynthesis; DNA replication; etc.) and relate these mechanisms to overall biological systems (for example energy production and flow; circulatory systems in plants and animals; ecological systems) and how they work.

Biotechnology, BS

The following outcomes describe the expected competencies for students completing the undergraduate Biotechnology program.

- PLO 1
  - Demonstrate proficiency in standard laboratory skills and a solid understanding of fundamental biotechnology techniques.
- PLO 2

    - Understand and describe concepts of scientific rigor, reproducibility, and quality control.
- PLO 3
    - Communicate concepts of biotechnological applications to solve real-world problems.

Chemistry

The following outcomes describe the expected competencies for students completing the undergraduate Chemistry programs.

Chemistry BS

Knowledge: Appropriately apply presented concepts and chemical principles to chemistry related issues.

Chemistry BA

Knowledge: Appropriately apply presented concepts and chemical principles to chemistry related issues.

BSE General Science Chemistry Emphasis

- Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure.
- Effective teachers of science understand how students learn and develop scientific knowledge. Preservice teachers use scientific inquiry to develop this knowledge for all students.
- Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select
  learning activities, instructional settings, and resources-- including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the earning goals are met.
- Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure.
- Effective teachers of science provide evidence to show that P-12 students’ understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach.

- Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.

Environmental Sciences

The following outcomes describe the expected competencies for students completing the undergraduate Environmental Sciences program.

- Students will be able to identify diversity as result of evolutionary and adaptive mechanisms while recognizing the underlying genetic principles and mechanisms of these processes.
- Students will be able to distinguish biological mechanisms (for example cellular respiration; photosynthesis; DNA replication; etc.) and relate these mechanisms to overall biological systems (for example energy production and flow; circulatory systems in plants and animals; ecological systems) and how they work.

Mathematics

The following outcomes describe the expected competencies for students completing the undergraduate Mathematics programs.

BS Mathematics

- B.S. Mathematics students will demonstrate the ability to think analytically to decipher challenging problems, utilize appropriate mathematical practices to construct mathematical arguments to solve them, and interpret their solutions.
- B.S. Mathematics students will demonstrate the ability to construct logical arguments and write formal mathematical proofs to establish the truth of mathematical statements.
- B.S. Mathematics students will demonstrate the ability to communicate mathematics effectively.

BSE Mathematics

> as prescribed by the specialized accreditor, CAEP

- **Knowing and Understanding Mathematics**: Candidates demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications within and among mathematical domains of Number; Algebra and Functions; Calculus; Statistics and Probability; Geometry, Trigonometry, and Measurement.

- **Knowing and using mathematical processes**: Candidates demonstrate, within or across mathematical domains, their knowledge of and ability to apply the mathematical processes of problem solving; reason and communicate mathematically; and engage in mathematical modeling. Candidates apply technology appropriately within these mathematical processes.
- **Knowing students and Planning for Mathematical Learning**: Candidates use knowledge of students and mathematics to plan rigorous and engaging mathematics instruction supporting students' access and learning. The mathematics instruction developed provides equitable, culturally responsive opportunities for all students to learn and apply mathematics concepts, skills, and practices.
- **Teaching Meaningful Mathematics**: Candidates implement effective and equitable teaching practices to support rigorous mathematical learning for a full range of students. Candidates establish rigorous mathematics learning goals, engage students in high cognitive demand learning, use mathematics specific tools and representations, elicit and use student responses, develop conceptual understanding and procedural fluency, and pose purposeful questions to facilitate student discourse.
- **Impact on student learning**: Candidates assess and use evidence of students' learning of rigorous mathematics to improve instruction and subsequent student learning. Candidates analyze learning gains from formal and informal assessments for individual students, the class as a whole, and subgroups of students disaggregated by demographic categories, and they use
this information to inform planning and teaching.
- **Social and professional context of mathematics teaching and learning**: Candidates are reflective mathematics educators who collaborate with colleagues and other stakeholders to grow professionally, to support student learning, and to create more equitable mathematics learning environments.
- **Secondary field experiences and clinical practice**: Effective teachers of secondary mathematics engage in a planned sequence of field experiences and clinical practice in diverse settings under the supervision of experienced and highly qualified mathematics teachers. They develop a broad experiential base of knowledge, skills, effective approaches to mathematics teaching and learning, and professional behaviors across both middle and high school settings that involve a diverse range and varied groupings of students. Candidates experience a full-time student teaching/internship in secondary mathematics supervised by university or college faculty with secondary mathematics teaching experience or equivalent knowledge base.

Physics

The following outcomes describe the expected competencies for students completing the undergraduate Physics programs.

Physics BS

- **Phenomena**
Describe observed and modeled phenomena using fundamental physical principles and

calculus-based mathematics.

- **Communication**
  Effectively communicate, both oral and written, to various audiences (layperson and professional) using appropriate terminology.
- **Instrumentation**
  Demonstrate appropriate use of and the ability to troubleshoot standard research laboratory instrumentation.
- **Literature**
  Use commercially available databases to search the primary scientific literature.
- **Ethics**
  Demonstrate the development of standards expected of professional scientists.

BSE General Science Physics Emphasis

- Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure.
- Effective teachers of science understand how students learn and develop scientific knowledge. Preservice teachers use scientific inquiry to develop this knowledge for all students.
- Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources-- including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the earning goals are met.
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- Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.

Wildlife, Fisheries and Conservation, BS (Wildlife; Conservation)

The following outcomes describe the expected competencies for students completing the undergraduate Wildlife, Fisheries and Conservation program.

- Students will be able to identify diversity as result of evolutionary and adaptive mechanisms while recognizing the underlying genetic principles and mechanisms of these processes.
- Students will be able to distinguish biological mechanisms (for example cellular respiration; photosynthesis; DNA replication; etc.) and relate these mechanisms to overall biological systems (for example energy production and flow; circulatory systems in plants and animals; ecological systems) and how they work

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Revision #4
Created 2025-08-19 18:39:52 UTC by William Murry
Updated 2025-09-19 21:19:43 UTC by William Murry