Department of Physics and Astronomy

B.S. Physics: Mission, Objectives and Outcomes

Mission: As part of the overall mission of Western Washington University and the College of Sciences and Technology, the mission of the Department of Physics and Astronomy is to:

- Provide a curriculum in Physics and Astronomy with the breadth and depth to facilitate and support effective learning in the core areas of the discipline at all levels;
- Provide a range of courses in Physics and Astronomy that enhance the education of students of the Humanities, Arts, and Social Sciences;
- Provide the core curriculum in Physics for future Physics teachers and for science teachers in all disciplines;
- Provide courses at a variety of levels that serve the needs of other major programs within the College of Sciences and Technology;
- Provide students with opportunities to participate in original research, and encourage and support faculty research and the improvement of pedagogical methods;
- Provide an overall supportive and sustainable working and learning environment for students, faculty, and staff.

Objectives: Within three to five years of graduation, graduates of the program will

1) Utilize conceptual knowledge and problem-solving skills in a variety of situations.
2) Apply core Physics principles to problems in professional or academic settings.
3) Effectively communicate ideas and strategies to colleagues.
4) Actively demonstrate the ability to work individually and in groups.
5) Continue to add to personal core knowledge and professional skill sets as life-long learners.

Outcomes: Upon graduation from the department of Physics and Astronomy, students will:

1) Have demonstrated mastery of the core concepts of Physics.
2) Have demonstrated understanding of quantitative reasoning and scientific inquiry.
3) Have demonstrated an ability to use lab equipment and interpret data.
4) Have demonstrated an ability to communicate ideas effectively, both verbally and in written form.
5) Have demonstrated an ability to solve problems, both independently and in groups.

Mapping of Program Objectives to Program Outcomes.

Table1: the relationships between program outcomes and the program objectives.

Objectives	Program Outcomes				
	1	2	3	4	5
1	X	X			X
2	X				
3				X	
4					X
5	X	X	X	X	X

Mapping of Course Outcomes to Program Outcomes.

Table2: the relationships between student course performance and program outcomes.

Courses	Program Outcomes				
	1	2	3	4	5
Phys 363	X	X			X
Phys 335	X	X			X
Phys 368	X	X			X
Phys 455	X	X			X
Phys 419		X	X	X	
Phys/Astr 39X			X	X	X

Course outcomes for courses listed in Table 2.

Course outcomes are measured according to particular assessment tools.

Physics 455 Quantum Mechanics I (QM).
After completing Physics 455, students should have:

- Thorough understanding of the core concepts of QM, including probability, Schrodinger's equation, wave function mechanics, ensemble averages, and measurement.
- Thorough understanding of the mathematical tools for QM, including linear algebra, expansion of functions in discrete and continuous bases, partial differential equations, and Dirac notation.
- Thorough understanding of the relationship between the QM theoretical structure and the outcomes of measurements in the lab.

Physics 363 Classical Mechanics.
After completing Physics 363, students should:

- Understand and be able to apply core concepts of classical mechanics, including Newton's laws, conservation principles, the principle of superposition, variational principles, and fictitious forces in non-inertial reference frames,
- Demonstrate facility with the mathematical tools and methods of classical mechanics, including the use of non-Cartesian coordinate systems, generating and solving the differential equations that describe the behavior of physical systems, Taylor and Fourier series, gradient and curl, and the calculus of variations.
- Be able to apply concepts and mathematical tools to thoroughly analyze and understand selected "touchstone" physical systems, such as the oscillator and the two-body central force problem.

Physics 335, Statistical Mechanics.
After completing Physics 335, students should:

- Have a thorough understanding of the core concepts of Thermodynamics and Statistical Mechanics, including the laws of thermodynamics, multiplicities and Entropy, Free energies, Boltzmann Statistics and Quantum Statistics.
- Be able to apply of these concepts to model systems like paramagnets, ideal gases and Einstein solids.
- Be able to use computational tools for statistical analysis.

Physics 368 Electricity and Magnetism.

After completing Physics 368, students should:

- Have a thorough understanding of the core concepts of vector analysis, including scalar and vector products, differential and integral vector calculus in rectangular and curvilinear coordinates, the Dirac delta function.
- Have a thorough understanding of electrostatics in free space and in matter, including the divergence and curl of electric fields, electric potential, work and energy in electrostatics, and electrostatics in conductors.
- Have a thorough understanding of magnetostatics in free space and in matter, including the divergence and curl of magnetic fields due to steady currents, and magnetization
- Be able to apply the theory to dielectrics and magnetic materials, including connections to measurements.