Syllabus for Central Forces

PH 426

Course Name: Paradigms in Physics: Central Forces
Course Number: PH 426
Course Credits: 3
Prerequisites: PH 213, PH 425, PH 422; coreqs: PH 335

Course Catalog Description

Gravitational and electrostatic forces; angular momentum and spherical harmonics, separation of variables in classical and quantum mechanics, hydrogen atom.

Student Learning Outcomes

Students shall be able to:

• Explain when the angular momentum of a system is conserved
• Apply Kepler’s laws to determine properties of planetary orbits
• Recognize boundary conditions suitable for a problem with rotational symmetry
• Solve for properties of the particle confined to a ring, rigid rotor, and the hydrogen atom
• Apply Schroedinger time dependence to central forces systems
• Sketch the first few eigenstates of the hydrogen atom, and geometrically interpret its quantum numbers

Course Content

Physics:

• Conservation of classical and quantum angular momentum and energy
• Effective potential
• Classical orbits and scattering
• Quantum mechanics with central forces in one, two, and three dimensions
• Hydrogen atom

Math:
• Separation of variables for ordinary differential equations
• Separation of variables for partial differential equations
• Legendre polynomials and spherical harmonics
• Eigenfunction expansions in one, two, and three dimensions
• Series solutions for ordinary differential equations

Learning resources

Required textbooks:
• *Quantum Mechanics: A Paradigms Approach*
  by David McIntyre

Evaluation of Student Performance

Students will be graded on weekly homework, lab reports, and midterm and final exams.

Statement Regarding Students with Disabilities

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at [http://ds.oregonstate.edu](http://ds.oregonstate.edu). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Link to Statement of Expectations for Student Conduct

[http://oregonstate.edu/studentconduct/offenses-0](http://oregonstate.edu/studentconduct/offenses-0)