

Physics 104 – Introductory Physics (4) Course Outline GE B3

Prerequisites for Phys 104: Passing score on ELM examination, or an ELM exemption or credit in MATH 104

Recommended: High school physics. Not open to students who have credit in a college physics course. 4 lectures.

Learning Objectives and Criteria:

Upon completion of the course the student should be able to understand the concept and applications of:

- a: Average velocity, instantaneous velocity and acceleration,
- b: Components of vectors, such as displacement, velocity and acceleration,
- c: Trajectory problems in two dimensions,
- d: Force, weight and Newton's laws,
- e: Circular motion, centripetal acceleration and centripetal force, torque, rotational inertia and center of mass,
- *f: Gravitational force on earth and in astronomy,
- g: Linear momentum, collisions both elastic and inelastic,
- h: Work-energy theorem, kinetic and potential energy, conservation of energy,
- i: Gases, liquids, heat, temperature, specific heat, change of state, conduction, convection, radiation,
- j: Heat engines, order and disorder, entropy and the second law of thermodynamics,
- *k: Vibrations, period, waves, wavelength, standing waves, interference and diffraction,
- *l: Sound waves, music, stringed and wind instruments,
- *m: Light, reflections, flat and curved mirrors, images, refraction of light, lenses, interference, and diffraction and polarization,
- n: The electric force, electric field and electric potential,
- o: Batteries, resistance, Ohm's law, electric power,
- p: Magnetic force, magnetic field, motors and generators, electromagnetic induction, electromagnetic waves,
- q: Atomic structure, energy levels, light emission spectra, Bohr model, quantum model,
- r: Quantum mechanics, light quanta, photoelectric effect, uncertainty principle,
- s: Nuclear physics isotopes, radioactive decays (α , β , γ), fission and fusion reactions, mass-energy equivalence, nuclear power,
- t: Special relativity, length contraction, time dilation, simultaneity,
- u: General relativity, curvature of space, red and blue shift, black holes,
- v: Big Bang model, expansion of space-time.

*Indicates topics covered only briefly.

Text and References:

Conceptual Physics by Paul Hewitt, Pearson Addison Wesley and **Practicing Physics** by Paul Hewitt, Pearson Addison Wesley, 10th ed. 2006

Physics 104 is a survey course in classical and modern physics. It provides the student with an excellent background for understanding many of the phenomena encountered in everyday life and analyzing related problems. The scientific method is discussed and basic scientific concepts and vocabulary are articulated. In addition, these basic ideas will help the student to understand problems in other areas such as engineering, biology, geology and astronomy. Physics 104 thus satisfies the criteria for Science and Mathematics in area B.

Content and Method:

Method: Physics 104 is in a traditional lecture. There are occasional demonstrations.

Examinations and quizzes require the student to explain how he/she obtained the answer and thus to describe the reasoning, not just write and solve formulas. Typically this written portion will constitute one-third to one-half of the credit given. A variety of multiple choice and short answer formats has been used. Exams tend to be conceptual with few quantitative questions. Different faculty may give somewhat different weights to the different aspects of assessment, but the variation among faculty is small. Learning depends on discussion of homework, quizzes based on homework and examinations of the principles discussed in class.

Content: Physics 104 will adhere to the following topics:

- Motion and Forces
- Circular Motion and Torque
- Gravity and Momentum
- Energy
- Atoms, Gases and Liquids
- Heat and Entropy
- Electric Force, Electric Field and Electric Potential
- Electromagnetism, including Electromagnetic Induction and Electromagnetic Waves
- Atomic Physics
- Quantum Mechanics
- Nuclear Physics
- Special and General Relativity
- Some Vibrations and Waves
- Some Properties of Light