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NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY
PHY 100 – ELEMENTS OF PHYSICS (4 CR.)

Course Description

Covers basic concepts of physics, including Newtonian mechanics, properties of matter, heat transfer, waves, fundamental behavior of gases, optics, ionizing radiation, and fundamentals of electricity and magnetism. The assignments in the course require college-level reading fluency, coherent written communication, application of arithmetic, exponents, and algebraic skills such as solving for an unknown variable in an equation and finding the slope and intercept from the equation of a line. **This is a Passport and UCGS transfer course.** Lecture 3 hours, Laboratory 3 hours, Total 6 hours per week.

General Course Purpose

PHY 100 improves the scientific and quantitative literacy of students through the study and application of a wide range of physical concepts. The course focuses on the conceptual descriptions of physical phenomena instead of mathematical rigor.

Course Prerequisites/Corequisites

None.

Course Objectives

Upon completing the course, the student will be able to:

Scientific Reasoning
- Apply the methods of scientific reasoning as related to physics that will be useful in their chosen occupational field and/or personal lives

Laboratory Methods
- Become acquainted with measurement and laboratory research methods

Applications
- Become acquainted with the applications of today's science and technology

Quantitative Analysis
- Apply problem-solving methods to physical situations

Communication
- Explain and interpret scientific reasoning, demonstrate listening skills, and the appropriate verbal and non-verbal responses in different contexts such as interpersonal relations and group discussions

Units
- Identify units (AES and SI) associated with physical quantities
- Convert non-base units to base units (e.g. minutes to seconds)

Scientific Method
- Identify steps in the scientific method
- Apply the scientific method in physical experiments

Kinematics
- Identify, differentiate among, and perform calculations using distance, time, speed, displacement, velocity, and acceleration

- Identify and differentiate between scalar and vector quantities
- Describe different types of motion in one and two dimensions, and the conditions for which they occur
- Identify and perform calculations using centripetal acceleration

Newton's Laws
- Describe a force and how it affects the motion of an object
- Identify various types of forces in physical situations
- Define Newton's laws of motion and apply them to physical situations

Gravitation
- Describe Newton's law of universal gravitation and how it depends on mass and distance
- Apply Newton's law of universal gravitation to circular orbits
- Describe a gravitational field and how it related to the gravitational force

Work and Energy
- Define work and describe how it relates to forces
- Define kinetic energy and potential energy and describe how they relate to work
- Differentiate among the different types of potential energies and kinetic energy
- Identify conditions in which mechanical energy is conserved
- Apply conservation of mechanical energy to physical situations
- Define power and describe how it relates to work and energy
- Apply the definition of power to physical situations

Momentum
- Define momentum and describe how it relates to Newton's second law
- Identify conditions in which momentum is conserved
- Apply conservation of momentum to physical situations
- Describe and differentiate between elastic and inelastic collisions

Rotational Motion
- Describe torque and how it relates to static equilibrium
- Define concept of angular momentum for point particle and rigid object
- Apply conservation of angular momentum to physical situations

Physics of Matter
- Identify and differentiate among various states of matter
- Define density and describe how it relates to mass and volume
- Define pressure and describe how it relates to force
- Describe and differentiate between absolute pressure and gauge pressure
- Apply the definition of pressure to find the gauge pressure in a static fluid
- Describe Pascal's principle and how it relates to pressure
- Describe Archimedes' principle and how it relates to the buoyant force
- Describe an ideal moving fluid and how it relates to the continuity equation
- Describe Bernoulli's principle and how it relates to pressure and the motion of a fluid

Heat
- Convert different temperature scales from one to another
- Describe thermal expansion and how it relates to temperature
- Define the ideal gas law and describe how it relates pressure, volume, and temperature
- Define heat and relate the heat transferred in materials to temperature
- Describe and differentiate between methods of heat transfer
- Describe the first and second law of thermodynamics and how they relate to energy and work
- Apply the laws of thermodynamics to physical situations

Waves
- Describe a wave and identify its various properties

- Describe and differentiate between transverse and longitudinal waves
- Identify the relationship among wavelength, period, frequency, and wave speed
- Describe a standing wave and how it relates to the boundary conditions
- Define diffraction of waves and differentiate its behavior from a particle in the same physical situation
- Describe intensity of a wave and how it relates to sound level
- Describe the Doppler effect and how it relates to frequency

Electricity and Electric Circuits

- Identify the different types of electrical charges and how they interact
- Define electric force described by the Coulomb's law and describe how it depend on charges and distance
- Define concepts of electric field including electric field due to point charges and explain its relation to electric field, charge and electric force
- Define concept of electric potential and explain its relation to electric potential charge and charge
- Define current and apply the definition to physical situations
- State Ohm's law and define resistance and resistivity of materials
- Differentiate between ohmic and nonohmic materials
- Identify resistors in a circuit and whether they are in parallel or series
- Define the electrical power absorbed or dissipated by a device in terms of current and electric potential
- Describe and differentiate between direct current and alternating current

Electromagnetism

- Describe magnetic poles and how they differ from electric charges
- Describe magnetic fields and how they relate to magnetic poles
- Identify how currents generate magnetic fields
- Define the magnetic force on moving charges and describe its orientation to the velocity and magnetic field
- Describe Faraday’s law and its applications
- Explain how electromagnetic wave are produced and identify the different types of waves in the electromagnetic wave spectrum

Optics

- Describe the law of reflection and law of refraction
- Describe the conditions for total internal reflection
- Apply the law of reflection and law of refraction to mirrors and lenses, respectively
- Describe resolution using diffraction of light
- Describe the interference pattern for single slit, double slit, and other aperture shapes
- Describe and differentiate between polarized and unpolarized light

Atomic Physics

- Describe the Bohr model of the atom in terms of quantized angular momentum, radii, and energy levels
- Describe the de Broglie hypothesis for matter waves and apply it to physical situations
- Identify the relation between energy and frequency for matter waves
- Identify the relation between momentum and wavelength for matter waves
- Describe blackbody radiation and its relation to temperature and energy quantization
- Describe the photoelectric effect and its applications

Nuclear Physics

- Identify and differentiate among mass number, atomic number, neutron number, and isotopes
- Describe and differentiate among the different types of radioactive decays
- Define the half-life of an isotope and relate it to the number of nuclei in a sample
- Define the binding energy of an isotope and describe how it relates to mass
- Apply the concept of binding energy to fission and fusion processes

Major Topics to be Included

Units
Scientific Method
Kinematics
Newton's Laws
Gravitation
Work and Energy
Momentum
Rotational Motion
Physics of Matter
Heat
Waves
Electricity and Electric Circuits
Electromagnetism
Optics
Atomic Physics
Nuclear Physics