

Physics 030 – Earth & Space Science-1
For Science and Engineering Majors; Currently in Session at Howard University

Introduction to Earth and Space Physical Science

1. Introduction and Overview
 - a. Objectives of the Course
 - b. Overview of Earth & Space Science
 - c. Overview of Remote Sensing
2. The Size and Distance Scale of the Universe
3. Properties of Matter
 - a. Fundamental properties of matter: solids, liquids, gases
 - b. Fundamental properties of matter: atoms, molecules, subatomic particles
 - c. Structure of atoms and molecules; quantum mechanical interpretation
 - d. The atomic nucleus; nuclear reactions and radioactive decay
4. Forms of Energy
 - a. Potential Energy and Kinetic Energy
 - b. Newton's Laws of Motion and Gravity
 - c. Electric and Magnetic Fields; Effects on Charged Particles
 - d. Electromagnetic Radiation
 - e. Gravitational and Electromagnetic Potential Energy
 - f. Heat and Pressure Energy of Gases; Thermodynamics
5. Optics and Remote Sensing
 - a. Refractive Optics
 - b. Reflective Optics
 - c. Diffraction Gratings
 - d. Spectrometers and Spectrographs
6. Spectroscopy and Remote Sensing
 - a. Types of Spectra
 - b. Black Body Radiation
 - c. Spectral Line Radiation
 - d. The Hydrogen Atom and Its Spectrum
 - e. Atomic Spectroscopy
 - f. Molecular Spectroscopy
 - g. Spectroscopic Remote Sensing Measurement Techniques
7. Introduction to Orbits and Space Flight
 - a. Newton's Laws of Motion and Gravity

- b. Sub-orbital trajectories and hands-on demonstrations
- c. Orbits and deep-space trajectories
- d. Kepler's Laws of Orbital Motion
- e. Astronomical Coordinate Systems and Orbital Elements
- f. Space Flight and Rockets

II. Origins: How Did It All Begin?

- 1. In the Beginning: The Origin and Evolution of the Universe
- 2. The Energy Sources of Stars; Elemental Abundances
- 3. Origin of the Solar System
- 4. Formation and Early History of Earth
- 5. Geologic Time and Dating of the Rock Record
- 6. The Chemistry and Origin of Life

III. The Solid Earth

- 1. Rock and Mineral Types
- 2. Large Scale Structure of the Earth
 - a. Plate Tectonics
 - b. Volcanoes and Earthquakes
 - c. Continental Drift and Orogenesis
- 3. The Earth's Seasons

IV. The Earth's Hydrosphere and Cryosphere

- 1. The Earth's Hydrosphere
 - a. Characteristics of the Oceans and Sea Floor
 - b. Properties of Sea Water
 - c. Circulation and Waves in the Sea
 - d. The Earth's Tides
- 2. The Earth's Cryosphere
 - a. Glaciers and Ice Ages

V. The Earth's Atmosphere

- 1. The Structure and Composition of the Atmosphere
- 2. Thermal Properties of the Atmosphere
- 3. Effects of Solar Input and Earth's Rotation
- 4. Meteorology: The Study of Weather
- 5. Climatology: Long Term Trends
- 6. Aeronomy: The Middle and Upper Atmosphere
- 7. The Ionosphere

VI. The Near-Earth Space Environment

1. The Sun and Its Effects on Earth's Upper Atmosphere and Ionosphere
2. The Solar Wind and Effects on Earth's Magnetosphere and Plasmasphere
3. The Magnetosphere
4. The Plasmasphere and Radiation Belts
5. The Polar Auroras