**Miami-Dade Community College**

**PHY 3105 B Modern Physics**

**PHY 3105 - 3 credits**

Course Description

This course will provide students with a deep understanding areas of physics that lie beyond the scope of classical mechanics, thermo-dynamics and electromagnetism. Its content includes: the theory of relativity; wave properties of matter; an introduction to the quantum theory of atoms; the properties of molecules and solids; nuclear properties, interactions and applications; a brief description of elementary particles; and an overview of modern cosmology.
The course will emphasize descriptive models and problem-solving techniques.

Pre-requisites: PHY 2048 and PHY2049
Co-requisite: PHY3105L

Course Competencies

Competency 1. The student will demonstrate knowledge and comprehension of the conditions that led to development of modern physics by

a) Providing a historic perspective of classical mechanics, electromagnetism and thermodynamics.
b) Reviewing conservation laws and fundamental forces.
c) Summarizing the development of the atomic theory of matter until 1895.
d) Describing and analyzing the experimental results which brought about relativity and quantum theory

Competency 2. The student will demonstrate knowledge, comprehension, analysis and application of the theory of relativity by:

a) Deriving and applying the Lorentz transformation
b) Stating and analyzing the impact of .Einstein's postulates of special relativity.
c) Deriving important results of the theory of relativity such as time dilation, length contraction, equivalence of mass and energy, etc.
d) Describing the postulates and consequences of general relativity.
e) Describing and evaluating the tests of general relativity.

Competency 3. The student will demonstrate knowledge, comprehension and analysis of quantum theory, by:

a) Describing and analyzing its experimental basis.
b) Describing and analyzing the wave properties of matter.
c) Solving and interpreting the solutions of Schrodinger's equation.
d) Using Schrodinger's equation to analyze the behavior of several physical systems, including the harmonic oscillator, the hydrogen atom, and many-electron atoms.

Competency 4. The student will demonstrate knowledge, comprehension, analysis and application of the structure of the atom and the nucleus, by:

a) Describing and analyzing atomic spectra.
b) Describing and analyzing different models of the atom
c) Describing and analyzing the Rutherford experiment.
d) Describing and analyzing the different models of the nucleus.
e) Describing and analyzing nuclear forces.
f) Describing and analyzing nuclear decay and radioactivity.
g) Describing different nuclear reactions and defining the concept of cross section.
h) Describing and analyzing nuclear physics application such as nuclear medicine and archaeological dating.

Competency 5. The student will demonstrate knowledge, comprehension, analysis and application of solid state physics by:

a) Describing and analyzing the structure of solids.
b) Describing and analyzing different theories of electrical conductions.
c) Describing and explaining the behavior of semiconductors.
d) Describing and explaining the phenomenon of superconductivity

Competency 6. The student will demonstrate knowledge, comprehension, analysis and application of the properties of elementary particles by:

a) Tracing the historical development of the discovery of elementary particles.
b) Classifying the different types of elementary particles.
c) Describing and applying the different conservation laws and symmetries.

d) Describing the standard model, grand unifying theories and supersymmetry and the role of quarks, strings, and superstrings.

Competency 7. The student will demonstrate knowledge, comprehension and analysis of the current cosmological model by:

a) Describing and explaining the behavior of different types of astronomical bodies and events such as supernovae, stars, galaxies, quasars, etc.
b) Describing cosmologies accepted throughout history.
c) Describing and tracing the historical development of the Big Bang theory.
d) Describing and analyzing the experimental evidence giving rise to the Big Bang theory.
e) Describing and analyzing the role of dark matter and gravitation in cosmology.