Course Name: PHY-232 Engineering Physics III

Date Updated: 2/2022

Credit Hours/week: 3 hrs./wk. – 3 cr.

BEGINNING: SPRING 2022

Catalog Description: This is the final course of a three-semester, calculus-based physics sequence. Topics include geometric optics, Maxwell's equations in differential form, electromagnetic radiation and fundamentals of physical optics, the development of the Schroedinger Equation approach to quantum mechanics and selected applications of quantum theory to the understanding of atomic and nuclear structure

Prerequisite: PHY-133, MAT-230, PHY-233

Text: Sears & Zemansky's University Physics Volume II, Young & Freedman, Addison Wesley
Sears & Zemansky's University Physics Volume, Young & Freedman, Addison Wesley
Sears & Zemansky's Study Guide to Accompany University Physics Volume II, Young & Freedman, Addison *W*esley
Sears & Zemansky's Study Guide to Accompany University Physics Volume, Young & Freedman, Addison Wesley
Young & Freedman, Addison Wesley, Sears & Zemansky's Student Solutions Manual Accompany University Physics Volume II
Young & Freedman, Addison Wesley, Sears & Zemansky's Student Solutions Manual Accompany University Physics Volume III

Supplementary Material: Scientific calculator Materials: Specialized equipment, supplies, facilities, for classes limited by enrollment or restricted by accreditation and/or equipment limitations:

Syllabus:

Topics
Physical optics: revie*w* of Maxwell's equations in integral form; conversion to differential form
Physical optics: Maxwell's equations in differential form; derivation and interpretation of the electromagnetic wave equation; theoretical computation of the speed of light
Physical optics: electromagnetic wave solutions -- transverse nature of the electric and magnetic fields
Physical optics: electromagnetic plane wave solutions for transverse electric and magnetic fields; polarization
Special relativity: principle of relativity; role of Galilean transformation in classical physics
Special relativity: Einstein's postulates of relativity; Lorentz-Fitzgerald transformation; length contraction; time dilation
Special relativity: velocity transformations; space-time intervals
Special relativity: relativistic momentum; total relativistic energy; rest-mass energy; relativistic kinetic energy
Quantum mechanics: ideal black-body radiation, Planck's constant; photoelectric effect; photon; photon momentum
Quantum mechanics: historical experimental basis for quantum mechanics; De Broglie waves; electron diffraction
Quantum mechanics: review of classical wave equation; quantum dispersion relation for "matter *w*aves"; introduction to Schrodinger equation; wave function solution forms
Quantum mechanics: probabilistic interpretation of wave functions; probability density; normalization requirement; conditions of physical admissibility
Quantum mechanics: separation of variables; time-independent Schrodinger equation
Quantum mechanics: stationary "definite-energy" states; particle in a 1-d box
Quantum mechanics: expectation values; eigenvalues, operators
Quantum mechanics: wave packets; group velocity; Heisenberg uncertainty principle
Quantum mechanics: Schrodinger equation in three dimensions; electrical potential for hydrogenic atoms; Schrodinger equation for hydrogenic atoms; separation of variables

Quantum mechanics: quantum numbers -- principle, angular momentum, and magnetic
Quantum mechanics: ground state solution of the hydrogenic radial equation; energy levels; quantization of angular momentum; z-component quantization; spectroscopic notation; Zeeman & Stark effects
Quantum mechanics: electron spin; spin angular momentum; exclusion principle
Nuclear physics: Rutherford scattering experiments and the nucleus
Nuclear physics: nuclear radius; nuclear density; nuclear fission and fusion
Nuclear physics: nuclides and isotopes; binding energy
Nuclear physics: stability; radioactive decay; alpha decay, beta decay, theneutrino; electron capture; gamma radiation
Nuclear physics: decay sequences; nuclear reactions; fission and fusion
Introduction to particle physics
Introduction to particle physics (continued)

Format for Offering this Course: Traditional

Students are expected to adhere to the policies of the County College of Morris. These can be accessed at: (insert link here)

Statement of Expected Course LEARNING OUTCOMES

- Describe Special relativity: principle of relativity; and the role of Galilean transformation in classical physics
- Describe ideal black-body radiation, photoelectric effect; photon; photon momentum
- Apply Schrodinger equation in three dimensions for electrical potential for hydrogenic atoms
- Describe electron spin; spin angular momentum; exclusion principle and their application to Quantum Mechanics
- List examples of how characteristics such as stability; radioactive decay; alpha decay, beta deca*y*, the neutrino; electron capture; gamma radiation are used in the experimental process
- Use the scientific method to analyze and derive conclusions from collected data and information (Gen Ed)
- Explain the difference between a hypothesis, a theory and a law as they are used in science (Gen Ed)
- Learning Activities to Support General Education Outcomes: Lectures, demonstrations and in-class activities Assessment Methods related to General Education Outcomes: Exam questions that test a student's understanding of the presented material.

Statement of Relation to Curriculum(s);

Required for Engineering Science major; elective for Mathematics and Science majors; general education elective for other majors satisfying a science requirement through enrollment in calculus based lecture/laboratory physics.