ILLINOIS VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Natural Sciences Business

COURSE: PHY 2004

Date: 3/28/2011

Credit Hours: 5.0

Prerequisite(s): MTH1003 or equivalent or credit (or registration) in MTH 2001

Delivery Method:		
	☒ **Lecture**	**2 Contact Hours (1 contact = 1 credit hour)**
	☒ **Seminar**	**1 Contact Hours (1 contact = 1 credit hour)**
	☒ **Lab**	**2 Contact Hours (2 contact = 1 credit hour)**
	☐ **Clinical**	**0 Contact Hours (3 contact = 1 credit hour)**
	☐ **Online**	
	☐ **Blended**	

Offered: ☐ **Fall** ☒ **Spring** ☐ **Summer**

IAI Equivalent –***Only for Transfer Courses***-go to *http://www.itransfer.org*:

CATALOG DESCRIPTION:

This course is for students in the arts and sciences (not for chemistry, engineering and physics majors). This course includes the concepts of light and optics, electricity and magnetism, topics in modern physics including atomic and nuclear physics.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page of this form for more information.]

Upon completion of the course, the student will be able:

[Choose those goals that apply to this course.]

☒ To apply analytical and problem solving skills to personal, social and professional issues and situations.
☐ To communicate orally and in writing, socially and interpersonally.
☐ To develop an awareness of the contributions made to civilization by the diverse cultures of the world.
☒ To understand and use contemporary technology effectively and to understand its impact on the individual and society.
☒ To work and study effectively both individually and in collaboration with others.
☐ To understand what it means to act ethically and responsibly as an individual in one's career and as a member of society.
☐ To develop and maintain a healthy lifestyle physically, mentally, and spiritually.
☐ To appreciate the ongoing values of learning, self-improvement, and career planning.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals.]

Upon completion of the course, the student will be able to:

Outcome 1 *– Students will be able to demonstrate a basic understanding of electric fields including the sources of the fields and the concept of electrical potential.*

Competency 1.1 Students will be able to explain and use Coulomb's Law to solve problems.

Competency 1.2 Students will be able to explain the difference between a conductor and an insulator, and various ways how an object can receive a net charge

Competency 1.3 Students will be able to explain what is meant by an electric field and determine values for electric fields mathematically.

Competency 1.4 Students will be able to define electric potential and electric potential energy and solve problems involving these concepts.

Competency 1.5 Students will be able to explain what is meant by a capacitor and the term capacitance; determine the capacitance of a capacitor; combine capacitors which are in series or in parallel; and determine the energy stored in a charged capacitor.

Competency 1.6 Students will be able to explain what is meant by a dielectric and how a dielectric affects the capacitance of a capacitor and the energy stored in a capacitor.

Outcome 2 *– Students will be able to demonstrate a basic understanding of resistive and R-C circuits, power, and basic circuit design.*

Competency 2.1 Students will be able to define the terms: current, electrical resistance, electromotive force, electric work and power, and solve problems involving these concepts, especially problems involving Ohm's Law.

Competency 2.2 Students will be able to combine resistors in series and in parallel and solve problems involving D.C. circuits by applying Kirchoff's Laws.

Competency 2.3 Students will be able to explain the principles of operation and uses of ammeters, voltmeters, ohmmeters, potentiometers, and solve problems involving these instruments.

Competency 2.4 Students will be able to solve problems involving R-C series circuits.

Outcome 3 *– Students will be able to demonstrate a basic understanding of magnetic fields including the sources of the fields and the effects they have on moving particles.*

Competency 3.1 Students will be able to compute the force on a charged particle due to a magnetic field and determine the motion of a charged particle in a magnetic field.

Competency 3.2 Students will be able to compute the magnetic force on a current-carrying wire or coil and the magnetic torque on a current-carrying coil.

Competency 3.3 Students will be able to compute the magnetic field produced by a current-carrying conductor.

Outcome 4 *– Students will be able to demonstrate a basic understanding of dynamic electromagnetic fields and their applications to simple electronics.*

Competency 4.1 Students will be able to describe what is meant by, and compute, a nonelectrostatic field and an induced electric field.

Competency 4.2 Students will be able to know and apply Faraday's Law and Lenz's Law to the solution of problems involving induced electric fields, including motional emfs.

Competency 4.3 Students will be able to solve simple problems involving transformers.

Competency 4.4 Students will be able to define mutual and self inductance and the energy associated with an inductor.

Competency 4.5 Students will be able to solve problems involving R-L and L-C circuits.

Outcome 5 – Students will be able to demonstrate a basic understanding of geometrical optics including refraction, reflection, lenses, mirrors, and various optical devices.

Competency 5.1 Students will be able to know and apply the laws of reflection and refraction of light to the solution of problems.

Competency 5.2 Students will be able to describe the dispersion of light by a prism and by lenses.

Competency 5.3 Students will be able to describe total internal reflection of light and solve problems involving total internal reflection.

Competency 5.4 Students will be able to describe, in words and determine graphically and mathematically, the formation of images by a single reflection or refraction at a plane or spherical surface. This includes determining the position and size of any image formed.

Competency 5.5 Students will be able to describe in words and compute mathematically and graphically the position and size of images formed by lenses and various optical instruments, including the eye, the magnifier, the camera, the compound microscope, and the telescope.

Outcome 6 – Students will be able to demonstrate a basic understanding of the wave nature of light and its effects

Competency 6.1 Students will be able to be able to describe in words and mathematically the diffraction and interference of light by a single slit, a double slit, and a diffraction grating.

Competency 6.2 Students will be able to describe in words and mathematically the interference of light from coherent sources, by thin films, and by the Michelsen interferometer.

Competency 6.3 Students will be able to describe in words what is meant by a polarized light and four ways (reflection, double refraction,

absorption, and scattering) in which light may be polarized; solve simple problems involving polarized light.

Outcome 7 – Students will be able to demonstrate a basic understanding modern physics including, quantum mechanics, wave/particle duality, atomic physics, nuclear physics, and relativity

Competency 7.1 Students will be able to describe, in words, the photoelectric effect, the Compton effect; solve problems based on the photoelectric effect and the Compton effect.

Competency 7.2 Students will be able to describe, in words and mathematically, the structure of the atom, based on Bohr's model

Competency 7.3 Students will be able to describe the process of nuclear decay, its causes and resulting particles.

Competency 7.4 Students will be able to mathematically determine the energy of decaying particles and mass defect associated with nuclear decay

Competency 7.5 Students will be able to describe and mathematically use the concepts of special relativity for discussions and problem solving.

COURSE TOPICS AND CONTENT REQUIREMENTS:

1. Electric Charge, Electric Field and Gauss' Law
2. Electric Potential and Potential Energy
3. Capacitance and Dielectrics
4. Electric Current, Resistance, and Electric Power
5. Direct Current Circuits and Instruments
6. Magnetic Fields and Forces - Sources and Effects
7. Electromagnetic Induction and Faraday's Law
8. Inductance and AC circuits
9. Electromagnetic Waves
10. Geometric Optics -- Reflection and Refraction of Light; Image Formation by Lenses and Mirrors, Optical Instruments

11. Physical Optics -- Diffraction and Interference; Polarization

12. Quantum Theory and Atomic Models

13. Molecules and Solids

13 Nuclear Physics - Nuclear Structure; Nuclear Physics, Applications

14 Special Relativity

INSTRUCTIONAL METHODS:

1. Lectures and lecture demonstrations,. Interactive Lecture Demonstration (ILDs), Activity – based physics learning styles, and utilizing other audio-visual aids and technologies

2. Outside of class problem assignments and in class problem discussion sessions.

3. Micro-computer based laboratory exercises.

4. Examinations and quizzes

INSTRUCTIONAL MATERIALS:

Principles with Applications with MasteringPhysics®, 6/E *Douglas C. Giancoli, , 2009 Addison Wesley*

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

Reading of textbook, note taking, and participation in classroom discussions as well as performing laboratory experiments are required of the students. Students are assigned approximately 15 homework problems per Chapter. Solutions of graded problems are discussed after grading if and when necessary. Evaluation of the students will include written problem class tests and one problem-orientated comprehensive final exam, written reports of laboratory experiments, quizzes and homework assignments, and class participation.

OTHER REFERENCES

Physics for Scientists and Engineers 2nd ed: A Strategic Approach with Modern Physics (chs 1-42) w/Mastering Physics,
Randall D. Knight, Pearson/ Addison Wesley

Fundamentals of Physics, Halliday and Resnick, McGraw Hill.

Classical Dynamics of particles and systems, Thornton and Marion, 2004, Brooks/Cole

The Mechanical Universe

Physics Demonstration series, by Physics Curriculum and Instruction, 2001

Beyond the Mechanical Universe

Course Competency/Assessment Methods Matrix

Course Prefix, Number and Name	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	**Assessment of Student Learning**	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	**Direct/ Indirect**	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D		D					
Students will be able to demonstrate a basic understanding of electric fields including the sources of the fields and the concept of electrical potential.					X			X	X									X									X					
Students will be able to demonstrate a basic understanding of resistive and R-C circuits, power, and basic circuit design.					X			X	X									X									X					
Students will be able to demonstrate a basic understanding of magnetic fields including the sources of the fields and the effects they have on moving particles.					X			X	X									X									X					
Students will be able to demonstrate a basic understanding of dynamic electromagnetic fields and their applications to simple electronics.					X			X	X									X														
Students will be able to demonstrate a basic understanding of geometrical					X			X	X									X									X					

optics including refraction, reflection, lenses, mirrors, and various optical devices.																																
Students will be able to demonstrate a basic understanding of the wave nature of light and its effects					X			X	X								X												X			
Students will be able to demonstrate a basic understanding modern physics including, quantum mechanics, wave/particle duality, atomic physics, nuclear physics, and relativity					X			X	X								X												X			