# PHYS 121 - General Physics 2 Course Outline

**Approval Date:** 05/20/2013
**Effective Date:** 01/16/2018

**SECTION A**

| | |
|---|---|
| **Unique ID Number** | CCC000299725 |
| **Discipline(s)** | Physical Sciences |
| **Division** | Science and Engineering |
| **Subject Area** | Physics |
| **Subject Code** | PHYS |
| **Course Number** | 121 |
| **Course Title** | General Physics 2 |
| **TOP Code/SAM Code** | 1902.00 - Physics, General / E - Non-Occupational |
| **Rationale for adding this course to the curriculum** | minor reorganizing of SLOs |
| **Units** | 4 |
| **Cross List** | *N/A* |
| **Typical Course Weeks** | 18 |

**Total Instructional Hours**

| | **Contact Hours** |
|---|---|
| **Lecture** | 54.00 |
| **Lab** | 72.00 |
| **Activity** | 0.00 |
| **Work Experience** | 0.00 |
| **Outside of Class Hours** | 108.00 |

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|---|---|
| **Total Contact Hours** | 126 |
| **Total Student Hours** | 234 |
| **Open Entry/Open Exit** | No |
| **Maximum Enrollment** | |
| **Grading Option** | Letter Grade or P/NP |

**Distance Education Mode of Instruction**

**SECTION B**

**General Education Information:**

**SECTION C**

**Course Description**

**Repeatability** May be repeated 0 times

**Catalog Description** This algebra-based physics course covers electricity, magnetism, optics, and modern physics. Biological and medical applications are emphasized in this course.

**Schedule Description**

**SECTION D**

**Condition on Enrollment**

**1a. Prerequisite(s)**

- PHYS 120

**1b. Corequisite(s):** *None*

**1c. Recommended:** *None*

**1d. Limitation on Enrollment:** *None*

**SECTION E**

**Course Outline Information**

**1. Student Learning Outcomes:**

A. Communicate the principles of electricity and magnetism, optics, and modern physics, and solve qualitative problems on these topics.
B. Solve quantitative problems while demonstrating a thorough understanding of the application of electricity, magnetism, optics, and modern physics.
C. Implement laboratory experiment techniques correctly during the investigation of the lecture topics and express the results clearly in written laboratory reports.

**2. Course Objectives:** Upon completion of this course, the student will be able to:

A. Use the concepts of electric fields, voltage, capacitance, and batteries to solve problems - such as calculation of electric fields due to static charge distributions and magnetic fields due to current distributions.
B. Solve problems using Coulomb's Law and Ohm's Law.
C. Analyze electrical circuits (both D.C. and A.C.) using Kirchoff's current and voltage rules including consideration of current, potential difference, and power dissipation for each element.
D. Calculate magnetic forces on moving charged particles. Examples include the trajectory of a single charged particle in a magnetic field and torques acting on current loops.
E. Write a short essay describing a defibrillator, magnetic declination, eddy currents, or a ferrite core antenna.
F. Draw ray diagrams (the path of a light ray) for mirror and lens devices to find the location and size of an image.
G. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
H. Understand the limitations of classical physics and begin to develop an awareness of the importance of modern physics (i.e. quantum theory and special relativity) in the natural world. Specific modern physics examples include items 9-12.
I. Solve problems regarding a telephoto lens or characteristic x-rays.
J. Calculate the binding energy and half-life of nucleons.
K. Write a short essay on the theories governing stimulated emission in a laser, a nuclear reactor, radioactive dating, or nuclear fusion.

L. Estimate the dangers of x-ray or radioactive emissions.
M. Analyze real-world experimental data, including appropriate use of units and significant figures, and relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.
N.

**3. Course Content**

A. Electric Charge and Electric Field
    a. Static electricity
    b. Coulomb's Law
    c. The electric field
    d. Field lines
B. Electric Potential and Electric Energy; Capacitance
    a. Electric potential and potential difference
    b. Equipotential lines
    c. Electric dipoles
    d. Capacitance
    e. Dielectrics
C. Electric Currents
    a. The electric battery
    b. Electric current
    c. Ohm's Law
    d. Electric power
    e. Alternating current
D. DC Circuits and Instruments
    a. Resistors in series and in parallel
    b. EMF and terminal voltage
    c. Kirchhoff's Rules
    d. Circuits containing capacitors in series and in parallel
    e. Circuits containing a resistor and a capacitor
    f. DC ammeters and voltmeters
E. Magnetism
    a. Magnets and magnetic fields
    b. Electric currents produce magnetism
    c. Force on an electric current in a magnetic field; definition of B
    d. Force on an electric charge moving in a magnetic field
    e. Magnetic field due to a straight wire
    f. Ampere's Law
    g. Torque on a current loop; magnetic dipole movement
    h. Ferromagnetism; domains
F. Electromagnetic Induction and Faraday's Law; AC Circuits
    a. Induced EMF
    b. Faraday's Law of Induction; Lenz's Law
    c. EMF induced in a moving conductor
    d. Electric generators
    e. Transformers; transmission of power
    f. Inductance
    g. LRC series AC circuit
    h. Resonance in AC circuits; oscillators
G. Electromagnetic Waves
    a. Changing electric fields produce magnetic fields; Maxwell's equations

b. Production of electromagnetic waves
c. Light as an electromagnetic wave and the electromagnetic spectrum
d. Energy in EM waves

H. Light: Geometric Optics
a. The speed of light and index of refraction
b. Formation of images by spherical mirrors
c. Refraction: Snell's Law
d. Total internal reflection; fiber optics
e. Thin lenses

I. The Wave Nature of Light
a. Huygens' principle and the law of refraction
b. Interference - Young's double-split experiment
c. The visible spectrum and dispersion
d. Diffraction grating
e. The spectrometer and spectroscopy
f. Interference by thin films
g. Polarization

J. Optical Instruments
a. The camera
b. The human eye
c. The magnifying glass
d. Telescopes
e. Compound microscope
f. Lens aberrations
g. Limits of resolution; the Rayleigh criterion
h. Resolution of telescopes and microscopes
i. X-rays and X-ray diffraction

K. Special Theory of Relativity
a. Galilean-Newtonian relativity
b. The Michelson-Morley experiment
c. Postulates of the special theory of relativity
d. Simultaneity
e. Time dilation and the twin paradox
f. Length contraction
g. Four-dimensional space-time
h. mass increase
i. The ultimate speed
j. E-mc'2; mass and energy
k. Relativisitic addition of velocities
l. The impact of special relativity

L. Early Quantum Theory and Models of the Atom
a. Planck's quantum hypothesis
b. The photoelectric effect
c. Compton effect
d. Wave nature of matter
e. Electron microscopes
f. Early models of the atom
g. Atomic spectra
h. The Bohr model
i. de Broglie's hypothesis

M. Quantum Mechanics of Atoms

a. Quantum mechanics
b. The wave function
c. The Heisenberg uncertainty principle
d. Quantum mechanics of the hydrogen atom; quantum numbers
e. Complex atoms; the exclusion principle
f. The periodic table of elements
g. X-ray spectra and atomic number

N. Nuclear Physics and Radioactivity
a. Binding energy and nuclear forces
b. Radioactivity
c. Half-life
d. Decay series
e. Radioactive dating

O. Nuclear Energy; Effects and Uses of Radiation
a. Nuclear reactions
b. Nuclear fission; nuclear reactors
c. Fusion
d. Radiation damage
e. Dosimetry
f.

**4. Methods of Instruction:**

**Activity:**
**Discussion:**
**Experiments:**
**Lab:**
**Lecture:**

**5. Methods of Evaluation:** Describe the general types of evaluations for this course and provide at least two, specific examples.

**Typical classroom assessment techniques**

Exams/Tests -- Exams include symbolic, numeric, conceptual, and short paragraph questions.
Quizzes -- similar to exams
Research Projects -- Research projects may be used as a part of laboratory.
Oral Presentation -- Oral presentation of laboratory results is one possible format.
Projects -- Completion of weekly lab is required. Results include data, graphing, and explanation of processes and concepts used.
Group Projects -- Laboratory is a group activity. Problem solving assignments may also be completed as group work.
Class Participation -- Example problems worked in class may count toward a class participation grade.
Home Work -- Numeric, symbolic, and conceptual homework will be assigned in addition to written laboratory reports.
Lab Activities -- Lab includes data collection, analysis, and discussion. Results are summarized in the lab report.
Final Exam -- The final exam is comprehensive and similar in content to the midterms.

Letter Grade or P/NP

**6. Assignments:** State the general types of assignments for this course under the following categories and provide at least two specific examples for each section.

A. Reading Assignments

- Daily reading assignments in the two texts listed are required.

B. Writing Assignments
   - Chapter problem assignments in "Physics" are required weekly
   - Written laboratory reports are required every week

C. Other Assignments
   -

**7. Required Materials**

**A. EXAMPLES of typical college-level textbooks (for degree-applicable courses) or other print materials.**

Book #1:

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|---|---|
| Author: | James Walker |
| Title: | Physics |
| Publisher: | Addison-Wesley |
| Date of Publication: | 2013 |
| Edition: | 4/Ed |

Book #2:

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|---|---|
| Author: | Cutnell, J., K. Johnson |
| Title: | Physics |
| Publisher: | John Wiley and Sons |
| Date of Publication: | 2012 |
| Edition: | 9 |

Book #3:

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|---|---|
| Author: | Giancoli, Douglas |
| Title: | Physics : Principles with Applications |
| Publisher: | Addison-Wesley |
| Date of Publication: | 2013 |
| Edition: | 7th |

Manual #1:

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|---|---|
| Author: | Wilson, Jerry |
| Title: | Physics Laboratory Experiments 8th edition |
| Publisher: | Cengage Learning |
| Date of Publication: | 01-03-2014 |

Manual #2:

| | |
|---|---|
| Author: | Wilson, Jerry |
| Title: | Physics Laboratory Experiments Napa Valley College Edition |
| Publisher: | Heath |
| Date of Publication: | 01-01-1994 |

**B. Other required materials/supplies.**