NEW COURSE: COS-PHYS-112 College Physics II

1.0 Course Designations and Approvals

<table>
<thead>
<tr>
<th>Required course approvals:</th>
<th>Approval request date:</th>
<th>Approval granted date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Unit Curriculum Committee</td>
<td></td>
<td>5/27/10</td>
</tr>
<tr>
<td>College Curriculum Committee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optional designations:</th>
<th>Is designation desired?</th>
<th>Approval request date:</th>
<th>Approval granted date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education:</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Writing Intensive:</td>
<td>No</td>
<td></td>
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<tr>
<td>Honors</td>
<td>No</td>
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2.0 Course information:

<table>
<thead>
<tr>
<th>Course title:</th>
<th>College Physics II</th>
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</thead>
<tbody>
<tr>
<td>Credit hours:</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisite(s):</td>
<td>COS-PHYS-111</td>
</tr>
<tr>
<td>Co-requisite(s):</td>
<td>None</td>
</tr>
<tr>
<td>Course proposed by:</td>
<td>Department of Physics</td>
</tr>
<tr>
<td>Effective date:</td>
<td>August 2013</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Contact hours</th>
<th>Maximum students/section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>2</td>
</tr>
<tr>
<td>Lab</td>
<td></td>
</tr>
<tr>
<td>Studio</td>
<td></td>
</tr>
<tr>
<td>Other (workshop)</td>
<td>4</td>
</tr>
</tbody>
</table>
2. **Semester(s) offered** (check)

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

All courses must be offered at least once every 2 years. If course will be offered on a bi-annual basis, please indicate here:

2.b **Student Requirements**

**Students required to take this course:** (by program and year, as appropriate)
- GCCIS: Medical informatics (pre-med track)*, Networking, security, and systems administration
- CAST: Engineering technology (civil, electrical, computer, telecommunications, electrical/mechanical, manufacturing, mechanical), Packaging science, Environmental sustainability, health and safety
- COS: Biology, Biomedical sciences, Biochemistry, Environmental science, Diagnostic medical sonography
- CIAS: Imaging and photographic technology*

* Can choose to take University Physics

**Students who might elect to take the course:**
Any student seeking to fulfill a general education requirement.

In the sections that follow, please use sub-numbering as appropriate (eg. 3.1, 3.2, etc.)

3. **Goals of the course** (including rationale for the course, when appropriate):

3.1 To extend the analytical and experimental concepts developed in College Physics I to thermal phenomena, electrical and magnetic forces and fields, fundamental DC and AC circuits, and basic concepts of the photon and the atom.

3.2 To relate these phenomena to the everyday world and to the student’s academic discipline.

3.3 To develop the student’s ability for analytical thought, and to apply mathematics to solve physical problems.

3.4 To continue introducing the student to basic techniques of laboratory measurement, recording of data, graphical and analytical interpretation of data, and the estimation of uncertainties of measurement and their effect on results, as introduced in College Physics I.

4. **Course description** (as it will appear in the RIT Catalog, including pre- and co- requisites, and quarters offered). Please use the following format:

**COS-PHYS-112 College Physics II**
An introductory course in algebra-based physics focusing on thermodynamics, electricity and magnetism, and elementary topics in modern physics. Topics include heat and temperature, laws of thermodynamics, electric and magnetic forces and fields, DC and AC electrical circuits, electromagnetic induction, the concept of the photon, and the Bohr model of the atom. The course is taught using
both traditional lectures and a workshop format that integrates material traditionally found in separate lecture, recitation, and laboratory settings. (COS-PHYS-111). **Class 2, Workshop 4, Credit 4** (F, S, Su)

### 5.0 Possible resources (texts, references, computer packages, etc.)

5.1 Knight, Jones, Field, *College Physics, A Strategic Approach*, McGraw-Hill
5.2 Serway and Faughn, *College Physics*, Saunders
5.3 Cutnell and Johnson, *Physics*, Wiley

### 6.0 Topics (outline):

6.1 The ideal gas law and kinetic theory (~6 hours)
   6.1.1 Internal energy
   6.1.2 Temperature
   6.1.3 Heat
   6.1.4 Ideal gas law
   6.1.5 Kinetic theory
   6.1.6 Maxwell-Boltzmann distribution

6.2 Temperature and heat (~5 hours)
   6.2.1 Specific heat
   6.2.2 Phase transitions
   6.2.3 Latent heats
   6.2.4 Calorimetry
   6.2.5 Phase diagrams
   6.2.6 Humidity
   6.2.7 Thermal expansion/contraction

6.3 Transfer of heat (~5 hours)
   6.3.1 Convection
   6.3.2 Radiation
   6.3.3 Blackbody radiation
   6.3.4 Planck’s hypothesis of quantized energy
   6.3.5 Conduction

6.4 Thermodynamics (~11 hours)
   6.4.1 Zeroth law
   6.4.2 First law
   6.4.3 Second law
   6.4.4 Heat engines, heat pumps, and refrigerators
   6.4.5 Third law

6.5 Electrostatics (~12 hours)
   6.5.1 Electric charge, insulators, and conductors
   6.5.2 Charging by contact and induction
   6.5.3 Coulomb’s law
   6.5.4 Coulomb forces in the atom
   6.5.5 Electric field
   6.5.6 Equipotentials and electric fields
   6.5.7 Conductors in electrostatic equilibrium
   6.5.8 Capacitance, energy storage
6.6 Direct-current (DC) circuits (~12 hours)
   6.6.1 Current
   6.6.2 Resistance and Ohm’s law
   6.6.3 Series and parallel resistances and capacitances
   6.6.4 Current – voltage relations
   6.6.5 Batteries and EMF (electromotive force)
   6.6.6 Kirchhoff’s rules
   6.6.7 Electrical power
   6.6.8 Resistivity
   6.6.9 RC (resistive – capacitive circuit) time constant
6.7 Magnetic forces and fields (~11 hours)
   6.7.1 Charged particle in a magnetic field
   6.7.2 Force on a current-carrying wire
   6.7.3 Torque on a loop – principle of the DC motor
   6.7.4 Magnetic fields produced by current – carrying wires
6.8 Electromagnetic Induction (~8 hours)
   6.8.1 Faraday’s law
   6.8.2 Relativity of electric and magnetic fields
   6.8.3 Lenz’s law
   6.8.4 Motional EMF and the principle of an alternating current (AC) generator
   6.8.5 Inductors and transformers
6.9 AC Circuits (~11 hours)
   6.9.1 RMS quantities
   6.9.2 Capacitive reactance
   6.9.3 Inductive reactance
   6.9.4 Simple filters
   6.9.5 Resistor-inductor-capacitor circuit (RLC) resonance
6.10 Modern Physics (~6 hours)
   6.10.1 Photon, photoelectric effect
   6.10.2 Bohr atom and quantization
   6.10.3 Spectra
6.11 Experimental skills
   6.11.1 Predict and develop testable hypotheses
   6.11.2 Collect and analyze data, apply elementary statistics, make and interpret graphs; draw conclusions supported by data, and report results
   6.11.3 Use computers to acquire, analyze, and present experimental data

7.0 Intended course learning outcomes and associated assessment methods of those outcomes (please include as many Course Learning Outcomes as appropriate, one outcome and assessment method per row).

<table>
<thead>
<tr>
<th>Course Learning Outcome</th>
<th>Exams and quizzes</th>
<th>Workshop activities and homework assignments</th>
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<tbody>
<tr>
<td>7.1 Define and calculate</td>
<td>X</td>
<td>X</td>
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<tr>
<td>internal energy and</td>
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<tr>
<td>heat; define temperature</td>
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<tr>
<td>and temperature scales;</td>
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<tr>
<td>Section</td>
<td>Description</td>
<td>7.2</td>
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<tr>
<td>7.2</td>
<td>Define and calculate the specific heat capacity of a substance; describe phase transitions, define latent heats of a substance; interpret phase diagrams; describe humidity; define and apply thermal expansion/contraction</td>
<td>X</td>
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<tr>
<td>7.3</td>
<td>Describe convection and radiation; use the Stefan-Boltzmann law, describe the properties of blackbody radiation and Planck’s hypothesis of quantized energy; explain conduction and apply to heat transfer problems</td>
<td>X</td>
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<tr>
<td>7.4</td>
<td>Describe the zeroth law; explain the connection between work, heat, and internal energy; write and apply the first law; describe thermal processes; construct and interpret PV diagrams; calculate work and explain its connection to PV diagrams; define reversible, irreversible, and cyclic processes; write and apply the second law; describe properties of heat engines, heat pumps, and refrigerators; describe the third law</td>
<td>X</td>
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<tr>
<td>7.5</td>
<td>Demonstrate proficiency in using proper units and significant figures; identify and record the uncertainty inherent in all measurements; estimate the effect of measurement uncertainties on calculated quantities; collect and organize experimental data; use physically appropriate graphical and mathematical analysis of experimental data; draw and report conclusions supported by experimental data; use computer-based tools for data acquisition and analysis; use basic measurement devices safely and accurately</td>
<td>X</td>
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<tr>
<td>7.6</td>
<td>Describe the properties of electric charge, calculate the force between point charges; define electric field, calculate the electric field due to a combination of point charges</td>
<td>X</td>
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<tr>
<td>7.7</td>
<td>Define, relate and apply the concepts of electric potential and electric potential energy</td>
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<tr>
<td>7.8</td>
<td>Define capacitance and dielectric constant; calculate equivalent series/parallel capacitance</td>
<td>X</td>
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</tbody>
</table>
7.9 Define and apply the concepts of current, EMF, resistance, resistivity, electrical power; calculate series/parallel equivalent resistance; define and apply Kirchhoff’s rules, analyze RC circuits

7.10 Explain the source of magnetic fields, define magnetic field; calculate the force on a charged particle and a current carrying wire in a magnetic field; calculate torque on a current loop; calculate magnetic fields due to currents

7.11 Describe the relation between electric and magnetic fields; explain and apply electromagnetic induction; calculate magnetic flux, motional and induced EMFs; apply Faraday’s Law (electric generator); define inductance and apply to transformers

7.12 Explain the origin of line spectra in terms of the Bohr model; describe and calculate energy levels; list appropriate quantum numbers and relate them to energy level diagrams; explain the Pauli Exclusion Principle, describe the basic structure of the periodic table; describe elementary radioactivity

7.13 Construct circuits; apply electrical measurement techniques; demonstrate proficiency in using proper units and significant figures; identify and record the uncertainty inherent in all measurements; estimate the effect of measurement uncertainties on calculated quantities; collect, organize, analyze and report experimental data, use appropriate graphical and mathematical analysis of experimental data; draw and report conclusions supported by experimental data; use computer-based tools for data acquisition and analysis; use basic measurement devices safely and accurately

8.0 Program outcomes and/or goals supported by this course

8.1 To develop a basic understanding of the physical world and mathematical descriptions of it.

8.2 To practice the scientific process.

8.3 To develop basic laboratory skills, including the ability to analyze and report experimental results.
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<tbody>
<tr>
<td>8.4</td>
<td>To develop skill in applying mathematics to different physical situations.</td>
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<td>8.5</td>
<td>To provide an introductory physics course with appropriate depth for engineering technology, life science and other appropriate majors.</td>
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<tr>
<td>8.6</td>
<td>To develop a capacity for critical thinking and analysis, problem solving, and group-based learning.</td>
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<tr>
<td>9.0</td>
<td>General Education Learning Outcome Supported by the Course, if appropriate</td>
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<tr>
<td><strong>Communication</strong></td>
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<tr>
<td>Express themselves effectively in common college-level written forms using standard American English</td>
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<tr>
<td>Revise and improve written and visual content</td>
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<tr>
<td>Express themselves effectively in presentations, either in spoken standard American English or sign language (American Sign Language or English-based Signing)</td>
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<tr>
<td>Comprehend information accessed through reading and discussion</td>
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<tr>
<td><strong>Intellectual Inquiry</strong></td>
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<tr>
<td>Review, assess, and draw conclusions about hypotheses and theories</td>
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<tr>
<td>Analyze arguments, in relation to their premises, assumptions, contexts, and conclusions</td>
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<td>Construct logical and reasonable arguments that include anticipation of counterarguments</td>
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<td>Use relevant evidence gathered through accepted scholarly methods and properly acknowledge sources of information</td>
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<tr>
<td><strong>Ethical, Social and Global Awareness</strong></td>
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<tr>
<td>Analyze similarities and differences in human experiences and consequent perspectives</td>
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<tr>
<td>Examine connections among the world’s populations</td>
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<tr>
<td>Identify contemporary ethical questions and relevant stakeholder positions</td>
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<tr>
<td><strong>Scientific, Mathematical and Technological Literacy</strong></td>
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<tr>
<td>X</td>
<td>Explain basic principles and concepts of one of the natural sciences</td>
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<tr>
<td></td>
<td>Apply methods of scientific inquiry and problem solving to contemporary issues</td>
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<tr>
<td>X</td>
<td>Comprehend and evaluate mathematical and statistical information</td>
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<tr>
<td>X</td>
<td>Perform college-level mathematical operations on quantitative data</td>
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<td></td>
<td>Describe the potential and the limitations of technology</td>
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<tr>
<td></td>
<td>Use appropriate technology to achieve desired outcomes</td>
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<tr>
<td><strong>Creativity, Innovation and Artistic Literacy</strong></td>
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<tr>
<td>Demonstrate creative/innovative approaches to course-based assignments or projects</td>
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<tr>
<td>Interpret and evaluate artistic expression considering the cultural context in which it was created</td>
<td></td>
</tr>
</tbody>
</table>
### 10.0 Other relevant information (such as special classroom, studio, or lab needs, special scheduling, media requirements, etc.)

<table>
<thead>
<tr>
<th>10.1 Smart classroom</th>
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<tbody>
<tr>
<td>10.2 Access to a dedicated physics workshop room in Gosnell Hall</td>
</tr>
</tbody>
</table>