~~13-14~~-14-5c.

| LSC Use Only Proposal No: | UWUCC Use Only Proposal No: ~~12-29d~~ |
|---|---|
| LSC Action-Date: AP-10/4/12 | UWUCC Action-Date: App 9/30/14 Senate Action Date: App 11/4/14 |

**Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee**

| Contact Person(s) **Stan Sobolewski** | Email Address **sobolews@iup.edu** |
|---|---|
| Proposing Department/Unit **Physics** | Phone **7-4590 or 7-2370** |

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

**1. Course Proposals (check all that apply)**

____ New Course ____ Course Prefix Change ____ Course Deletion

_X_ Course Revision ____ Course Number and/or Title Change ____ Catalog Description Change

*Current* course prefix, number and full title: PHYS 112 Physics II Lecture

*Proposed* course prefix, number and full title, if changing:

**2. Liberal Studies Course Designations, as appropriate**

_X_ This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

____ Learning Skills _X_ Knowledge Area ____ Global and Multicultural Awareness ____ Writing Intensive (include W cover sheet)

____ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

____ Global Citizenship ____ Information Literacy ____ Oral Communication

____ Quantitative Reasoning ___ Scientific Literacy ____ Technological Literacy

**3. Other Designations, as appropriate**

____ Honors College Course ____ Other: (e.g. Women's Studies, Pan African)

**4. Program Proposals**

____ Catalog Description Change ____ Program Revision ____ Program Title Change ____ New Track

____ New Degree Program ____ New Minor Program ____ Liberal Studies Requirement Changes ____ Other

*Current program name:*

*Proposed program name, if changing:*

| 5. Approvals | Signature | Date |
|---|---|---|
| Department Curriculum Committee Chair(s) | | 4/23/2012 |
| Department Chairperson(s) | | 4/23/2012 |
| College Curriculum Committee Chair | Anne Kopko | 4/23/12 |
| College Dean | | 4/23/12 |
| Director of Liberal Studies (as needed) | | 9/25/12 |
| Director of Honors College (as needed) | | |
| Provost (as needed) | | |
| Additional signature (with title) as appropriate | | |
| UWUCC Co-Chairs | Gail S Sechrist | 9/30/14 |

Received SEP 10 2014 Liberal Studies

Received APR 24 2012 Liberal Studies

COURSE SYLLABUS

## I .CATALOG DESCRIPTION

PHYS 112 Physics II Lecture 3c-0l-3cr

Prerequisite: PHYS 111

Electricity and magnetism, heat, light, atomic and nuclear physics, and an elementary introduction to quantum theory.

## II. COURSE OBJECTIVES

(1) The students will demonstrate an understanding of the essential features of elementary electricity and magnetism.

EUSLO 1 *Informed Learners*

**Rationale**: Homework and tests will include questions on elementary electricity and magnetism. Working on these questions and solving these problems will inform the learner about the topics in the course.

EUSLO 1 *Informed Learners*

(2) The students will demonstrate an understanding of geometric optics as well as elementary wave optics and modern physics.

**Rationale:** Homework and tests will include questions on geometric optics, elementary wave optics and modern physics. Working on these questions and solving these problems will inform the learner about the topics in the course.

(3) The students will perform quantitative analysis of relatively simple physical systems involving the principles covered, using algebra and trigonometry.

EUSLO 1 *Informed Learners and* EUSLO 2 *Empowered Learners*

**Rationale**: Homework problems will require the students to quantitatively analyze simple physical systems. The ability to analyze simple physical systems will empower the learner to solve other such problems in the future.

(4) The students will demonstrate an understanding of some of the "great moments" in the history of physics.

EUSLO 1 *Informed Learners and* EUSLO 2 *Empowered Learners*

**Rationale**: Assignments and readings will mention the "great moments" Students will demonstrate knowledge and understanding of the interrelationships within and across disciplines. On a selected examination, the student will be asked to mention the contributions of a specified individual.

(5) The students will perform quantitative analysis of electrostatics, D.C. and A.C. circuits, magnetism, electromagnetism, reflection, refraction, interference, diffraction, and radioactivity.

EUSLO 1 *Informed Learners and* EUSLO 2 *Empowered Learners*

**Rationale:** Homework and tests will include questions on electrostatics, D.C. and A.C. circuits, magnetism, electromagnetism, reflection, refraction, interference, diffraction, and radioactivity. Working on these questions and solving these problems will inform the learner about the topics in the course.

## III. COURSE OUTLINE

A. Electrostatics (6 hours)
1. Coulomb's law
2. Electric field
3. Potential energy and potential
4. Potential difference
5. Capacitors
6. Dielectrics

B. D.C. circuits (6 hours)
1. Electric current
2. Resistance and Ohm's law
3. Voltage sources
4. Energy & power in electric circuits
5. Resistors in series and parallel
6. Kirchhoff's rules
7. Ammeters, voltmeters, and the Wheatstone Bridge

C. Magnetism (6 hours)
1. Magnetic force on moving charges
2. Magnetic fields produced by moving charges
3. Magnetic force on currents
4. Magnetic properties of materials
5. Induced voltages; Faraday's law & Lenz's law
6. Inductors
7. Motors/ generators, & transformers

D. A.C. circuits (5 hours)
1. RC, RL and RCL alternating-current circuits
2. Power & rms values in AC circuits
3. Resonance
4. Electrical safety

E. Light and geometric optics (6 hours)
1. Nature of electromagnetic waves
2. Reflection, refraction and dispersion
3. Mirrors
4. Thin lens & lens combinations
5. Lens aberrations
6. Optical instruments
7. The human eye

F. Physical optics (4 hours)
1. Young's double-slit experiment
2. Thin-film interference
3. Diffraction
4. Diffraction grating
5. Polarization

G. Quantum physics (3 hours)
1. The wave-particle nature of EM radiation
2. The wave-particle
3. The Bohr model of the atom
4. The laser
5. Quantum mechanics and the Pauli Exclusion Principle
6. Solid-state band theory & semiconductors

H. The nucleus (3 hours)

1. Nuclear structure & forces
2. Radioactive decay
3. Elementary particles
4. Ionizing radiation & safety
5. Nuclear fission & fusion

Three one hour exams (3 hours)
Two hour exam during exam week (2 hours)

## IV. EVALUATION METHODS

The final grade for the course will be determined from unannounced quizzes, problem assignments, collected and graded at least weekly; two one-hour examinations, and a final examination scheduled during the final exam period.

The final grade for the course will be determined as follows:

20% Problem assignments collected and graded daily.
60% three one-hour examinations consisting primarily of word problems to be solved, but also definitions of important terms and short essays.
20% Cumulative final examination

## V. GRADING SCALE

| Score | | | Grade |
|---|---|---|---|
| 100 % | to | 90% | A |
| 89% | to | 80% | B |
| 79% | to | 70% | C |
| 69% | to | 60% | D |
| Less than | | 60% | F |

## VI. ATTENDANCE POLICY

Students are expected to attend all lectures. Individual faculty members assigned to this course will determine the specific attendance requirements for this course. In certain situations, such as illness, personal emergency or active military duty, students will be excused for missing class if a written excuse or other proof of absence is provided to the instructor. Individual faculty members will determine how the assignments or other work will be made up in the event of an excused absence. The course attendance policy will be consistent with the Undergraduate Attendance Policy in the IUP Undergraduate Catalog.

## VII. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

**Textbook**: College Physics, (9th Edition) Hugh D. Young, Robert Geller (2012)

## VIII. SPECIAL RESOURCES

None noted.

## IX . BIBLIOGRAPHY

Bueche, F., Hecht, **Schaum's Outline of College Physics**, 11th Edition 2011, McGraw-Hill;

Giancoli, D., **Physics for Scientists and Engineers with Modern Physics,** 4th edition, 2008, Addison-Wesley

Knight, R., **Physics for Scientists & Engineers with Modern Physics**, 3rd Edition, 2013, Addison-Wesley

Serway, R., **Physics for Scientists & Engineers** 9th Edition, 2009, Brooks Cole

Wolfson, R., Essential **University Physics**, 2nd Edition, 2012 Addison-Wesley

Young, H., **College Physics,** 9th edition May 6, 2012, Addison Wesley

Young, H., Freedman, R., **University Physics with Modern Physics**, 11th Edition 2011, Addison Wesley

## VI. ATTENDANCE POLICY

Students are expected to attend all lectures and complete all labs. Individual faculty members assigned to this course will determine the specific attendance requirements for this course. In certain situations, such as illness, personal emergency or active military duty, students will be excused for missing class if a written excuse or other proof of absence is provided to the instructor. Individual faculty members will determine how the assignments or other work will be made up in the event of an excused absence. . Course attendance policy will be consistent with the Undergraduate Attendance Policy in the IUP Undergraduate Catalog.

**Liberal Studies Course Approval Checklist**
**Instruction Sheet**

Use this checklist for all Liberal Studies categories other than writing-intensive sections; a different checklist is available for this if you have questions, contact the Liberal Studies Office, 103 Stabley, telephone 357-5715

This checklist is intended to assist you in developing your course to meet IUP's Criteria for Liberal Studies and to arrange your proposal in a standard order for consideration by the Liberal Studies Committee (LSC) and the University-Wide Undergraduate Curriculum Committee. (UWUCC) When you have finished, your proposal will have these parts:

_X_ Standard UWUCC Course Proposal Cover Sheet, with signatures and Liberal Studies course designation checked

_X_ Course syllabus in UWUCC format

NA_ UWUCC course analysis questionnaire Needed only if this is a new course not previously approved by the University Senate These are not considered by the LSC but will be forwarded to the UWUCC along with the rest of the proposal after the LSC completes its review

*This is not a new course; it has been approved by the University Senate*

_X__ Assignment instructions for one of the major course assignments and a grading rubric or grading criteria for that assignment

_X__ Answers to the four questions listed in the Liberal Studies Course Approval General Information (one page)

Submit the original of the completed proposal to the Liberal Studies Office (103 Stabley) In addition to the signed hard copy, email the proposal as a Word or RTF file attachment to Liberal-Studies@iupedu

**Please Number All Pages**

**OLD COURSE SYLLABUS**

CATALOG DESCRIPTION
PHYS 112 Physics II Lecture **3c-0l-3cr**

Prerequisite: PHYS 111

Electricity and magnetism, heat, light, atomic and nuclear physics, and an elementary introduction to quantum theory.

## II COURSE OBJECTIVES

(1) To develop an understanding of the essential features of elementary electricity and magnetism.

(2) To develop an understanding of geometric optics as well as elementary wave optics and modern physics.

(3) To be able to perform quantitative analysis of relatively simple physical systems involving the principles covered, using algebra and trigonometry.

(4) To provide an understanding of some of the "great moments" in the history of physics.

(5) To provide demonstrations and examples of electrostatics, D.C. and A.C. circuits, magnetism, electromagnetism, reflection, refraction, interference, diffraction, and radioactivity.

(6) To use problem sets to develop the required mathematical skills and knowledge necessary to

## III. COURSE OUTLINE

A. Electrostatics (6 hours)
1. Coulomb's law
2. Electric field
3. Potential energy and potential
4. Potential difference
5. Capacitors
6. Dielectrics

B. D.C. circuits (6 hours)
1. Electric current
2. Resistance and Ohm's law
3. Voltage sources
4. Energy & power in electric circuits
5. Resistors in series and parallel
6. Kirchhoff's rules
7. Ammeters, voltmeters, and the Wheatstone Bridge

C. Magnetism (6 hours)
1. Magnetic force on moving charges
2. Magnetic fields produced by moving charges
3. Magnetic force on currents
4. Magnetic properties of materials

5. Induced voltages; Faraday's law & Lenz's law
6. Inductors
7. Motors/ generators, & transformers

D. A.C. circuits (3 hours)

1. RC, RL and RCL alternating-current circuits
2. Power & rms values in AC circuits
3. Resonance
4. Electrical safety

E. Light and geometric optics (6 hours)

1. Nature of electromagnetic waves
2. Reflection, refraction and dispersion
3. Mirrors
4. Thin lens & lens combinations
5. Lens aberrations
6. Optical instruments
7. The human eye

F. Physical optics (3 hours)

1. Young's double-slit experiment
2. Thin-film interference
3. Diffraction
4. Diffraction grating
5. Polarization

G. Quantum physics (3 hours)

1. The wave-particle nature of EM radiation
2. The wave-particle
3. The Bohr model of the atom
4. The laser
5. Quantum mechanics and the Pauli Exclusion Principle
6. Solid-state band theory & semiconductors

H. The nucleus (3 hours)

1. Nuclear structure & forces
2. Radioactive decay
3. Elementary particles
4. Ionizing radiation & safety
5. Nuclear fission & fusion

## IV. EVALUATION METHODS

The final grade for the course will be determined from unannounced quizzes, problem assignments, collected and graded at least weekly; two one-hour examinations, and a final examination (2 hours)

## V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

**Textbook**: College Physics, (8th Edition) Hugh D. Young, Robert Geller

## VI. ATTENDANCE POLICY

Students are expected to attend all lectures. Individual faculty members assigned to this course will determine the specific attendance requirements for this course. In certain situations, such as illness, personal emergency or active military duty, students will be excused for missing class if a written excuse or other proof of absence is provided to the instructor. Individual faculty members will determine how the assignments or other work will be made up in the event of an excused absence. Course attendance policy will not conflict with the University attendance policy.

**Liberal Studies Course Approval General Information**
**On a separate sheet of paper, please answer these questions**

(Do not include this sheet or copies of the questions in your proposal; submit only the answers)

1) There has been only section of this class offered since its inception, and there will continue to be only one section for the foreseeable future.

2) This is an introductory course in physics for science majors. The bulk of the course content is on the concepts of physics and problem solving. While minorities and women are not an emphasis of the course, ethnic and racial minorities as well as women are discussed. When appropriated, members of underrepresented populations will be discussed. An example would be Emmy Noether. She was a mathematician who did her work in the early 20th century. Noether's theorem has become a fundamental tool of modern theoretical physics and the calculus of variations. Noether's theorem is important, both because of the insight it gives into conservation laws, and also as a practical calculation tool.

3) Students enrolled in this course will be required to read a research articles from a physics journal selected by the instructor. The article will be from journals aimed at the general science community, such as *Science* or *Scientific American*. One article will be assigned for the entire class to read. One or two questions on an exam will be based on this article.

4) This class will use slightly less mathematics than the introductory physics class for majors, PHYS 131. The topics covered are essentially the same, but calculus is not used in problem solving.

**Part II SUMMARY OF CHANGE**

The primary objectives, topics and course activities are not being significantly changed. The purpose of this course revision is to map the course objectives to the new Liberal Studies Expected Undergraduate Student Learning Objectives. (EUSLO) This has been incorporated into the course objectives above.

**Part III letters of support**

None are necessary – The objectives of the courses have not changed, the objectives are being mapped to the new Liberal Studies Standards.

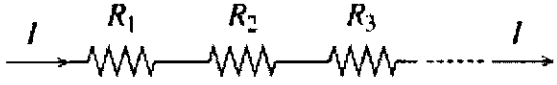
**Sample Assignment**

## Series And Parallel Connections

**Description:** Several calculations of increasing complexity that help the students practice finding the equivalent resistance of the circuits combining series and parallel connections.
**Learning Goal:** To learn to calculate the equivalent resistance of the circuits combining series and parallel connections.
Resistors are often connected to each other in electric circuits. Finding the **equivalent resistance** of combinations of resistors is a common and important task. Equivalent resistance is defined as the single resistance that can replace the given combination of resistors in such a manner that the currents in the rest of the circuit do not change.

Finding the equivalent resistance is relatively straight forward if the circuit contains only series and parallel connections of resistors.

An example of a **series connection** is shown in the diagram:




For such a connection, the current is the same for all individual resistors and the total voltage is the sum of the voltages across the individual resistors.

Using Ohm's law ( $R = \frac{V}{I}$ ), one can show that, for a series connection, the equivalent resistance is the sum of the individual resistances.

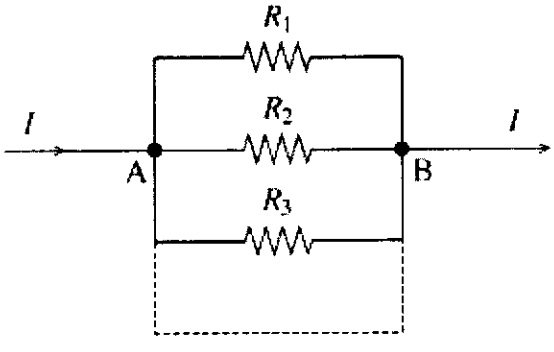
Mathematically, these relationships can be written as:

$$I = I_1 = I_2 = I_3 = \ldots$$

$$V = V_1 + V_2 + V_3 + \ldots$$

$$R_{eq\text{-}series} = R_1 + R_2 + R_3 + \ldots$$

An example of a **parallel connection** is shown in the diagram:




For resistors connected **in parallel** the voltage is the same for all individual resistors because they are all connected to the same two points (A and B on the diagram). The total current is the sum of the currents through the individual resistors. This should makes sense as the total current "splits" at points A and B.

Using Ohm's law, one can show that, for a parallel connection, the reciprocal of the equivalent

resistance is the sum of the reciprocals of the individual resistances.

Mathematically, these relationships can be written as:

$$V = V_1 = V_2 = V_3 = \ldots$$

$$I = I_1 + I_2 + I_3 + \ldots$$

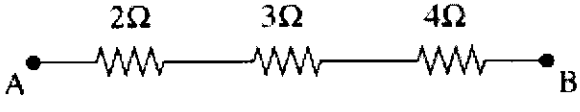
$$\frac{1}{R_{\text{eq-parallel}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

*NOTE*: If you have already studied capacitors and the rules for finding the equivalent capacitance, you should notice that the rules for the capacitors are similar - but not quite the same as the ones discussed here.

In this problem, you will use the the equivalent resistance formulas to determine $R_{eq}$ for various combinations of resistors.

**Part A**

For the combination of resistors shown, find the equivalent resistance between points A and B.




Express your answer in Ohms.

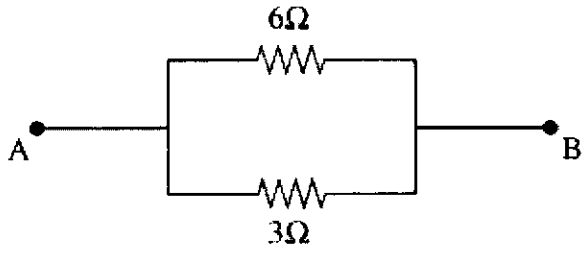
**ANSWER:** $R_{eq} = \frac{9}{9}\ \Omega$

These resistors are connected in *series*; the current through each is the same.

**Part B**

For the set-up shown, find the equivalent resistance between points A and B.

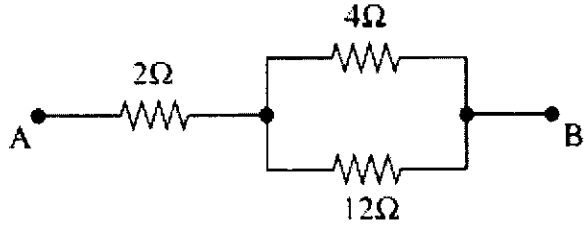
Express your answer in Ohms.




**ANSWER:** $R_{eq} = \dfrac{2}{2}\ \Omega$

This is a *parallel* connection since the voltage across each resistor is the same.

**Part C**




GRADING SCHEME.

This assignment is delivered on-line. Each student will access the web site and answer each question sequentially.

Question-specific feedback and follow-up text only appear when students are shown whether their answer is correct.

The students will have six attempts per question. If the student exhausts all attempts or gives up, the correct answer will be shown immediately.

There is a 3% reduction for each incorrect answer.

Deduct 3% credit for incorrectly answering any other type of question before the last attempt.

Students can view hints. There are questions within the hints which the student may answer for credit

Credit will be given for questions answered correctly in the hint.

Bonus credit of 2% will be given if the student does not open the hint

Deduct credit for exhausting all attempts or giving up on a question in a hint.