PHYS 240 - Physics for Scientists & Engineers 2 Course Outline

Approval Date: 11/08/2013
Effective Date: 08/11/2014

SECTION A

Unique ID Number	CCC000341596
Discipline(s)	
Division	Science and Engineering
Subject Area	Physics
Subject Code	PHYS
Course Number	240
Course Title	Physics for Scientists & Engineers 2
TOP Code/SAM Code	1902.00 - Physics, General / -
Rationale for adding this course to the curriculum	minor clarifications and modification to language. Alternate text added.
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

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 is a calculus-based introduction to the principles of heat, electricity, and magnetism. Topics include temperature, kinetic theory of gases, heat, laws of thermodynamics, electric charge and electric field, Gauss's Law, electric potential, capacitance, resistance, electric current, DC circuits, magnetism, sources of magnetism, Faraday's Law, inductance, and AC circuits. Transfers to: CSU, UC

Schedule Description

SECTION D

Condition on Enrollment

1a. Prerequisite(s)

- PHYS 140
- MATH 121

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 thermodynamic, electrical and magnetic theory and how they relate to properties of materials and energy. Solve problems related to these topics using qualitative reasoning.
B. Solve quantitative calculus level thermodynamic, electrical and magnetic problems while demonstrating a thorough understanding of the application of the Laws of Thermodynamics and field theory principles.
C. Implement laboratory experiment techniques correctly during the investigation of thermodynamic, electrical and magnetic systems 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 Kinetic Theory of Gases to find the speed of a gas molecule.
B. Solve calculus problems using the First and Second Laws of Thermodynamics.
C. Find the efficiency of a Carnot Engine.
D. Apply Newton's Laws to analyze the motion of charged particles in electric or magnetic fields.
E. Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
F. Use Kirchhoff's Laws to calculate all electric currents in a complex circuit.
G. Given a charge distribution, apply Gauss's Law to derive the resulting electric fields.
H. Analyze simple current distributions and calculate the resulting magnetic field.
I. Use Faraday's Law of Induction to calculate the voltage generated by sinusoidal magnetic fields.
J. Calculate the current in an RLC circuit.
K. Predict the trajectory of charged particles in uniform electric and magnetic fields.

L. Analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.

M.

3. Course Content

A. Temperature
   a. Thermometers and temperature scales
   b. The Constant-Volume Gas Thermometer and the Kelvin Scale
   c. Thermal expansion of solids and liquids
   d. Macroscopic description of an ideal gas

B. Heat and the First Law of Thermodynamics
   a. Heat capacity and specific heat
   b. Latent heat
   c. The first law of thermodynamics
   d. Heat transfer

C. The Kinetic Theory of Gases
   a. Molecular model of an ideal gas
   b. Adiabatic processes for an ideal gas
   c. The equipartition of energy
   d. The Boltzmann Distribution Law

D. Heat Engines, Entropy, and the Second Law of Thermodynamics
   a. Heat engines and the second law of thermodynamics
   b. The Carnot engine
   c. Heat pumps and refrigerators
   d. Entropy

E. Electric Fields (Electrostatics)
   a. Coulomb's Law
   b. The electric field
   c. Electric field lines
   d. Motion of charged particles in a uniform electric field

F. Gauss's Law
   a. Electric flux
   b. Gauss's Law
   c. Application of Gauss's Law to charged insulators
   d. Conductors in electrostatic equilibrium

G. Electric Potential
   a. Potential difference and electric potential
   b. Electric potential and potential energy due to point charges
   c. Energy stored in a charged capacitor
   d. Capacitors with dielectrics

H. Current and Resistance
   a. Electric current
   b. Resistivity, Resistance and Ohm's Law
   c. Superconductors
   d. Electrical energy and power

I. DC (Direct Current) Circuits
   a. Electromotive force
   b. Resistors in series and in parallel
   c. Kirchhoff's Rules
   d. RC circuits

J. Magnetic Fields

a. Magnetic force on a current-carrying conductor
b. Torque on a current loop in a uniform magnetic field
c. Motion of a charged particle in a magnetic field
d. The Hall effect

K. Sources of the Magnetic Field: A. The Biot-Savart Law
a. Ampere's Law
b. Displacement current
c. Magnetism in matter

L. Faraday's Law
a. Faraday's Law of Induction
b. Lenz's Law
c. Induced EMFs and electric fields
d. Generators and motors

M. Inductance
a. Self-inductance
b. RL circuits
c. Mutual inductance
d. Oscillations in an LC circuit

N. AC (Alternating Current) Circuits
a. AC sources and phasors
b. The RLC Series circuit
c. Resonance in a Series RLC circuit
d. The transformer and power transmission.

O. Maxell's Equations

P.

4. Methods of Instruction:

Discussion: classroom discussion of example problems
Experiments: Laboratory Experiments
Lab: Problem Solving Lab in Computer Laboratory
Lecture: Presentation of course material
Observation and Demonstration:

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 -- Multiple Choice Questions, Conceptual Questions, and Symbolic and Numerical Problems
Projects -- Lab Experiments with group
Home Work -- Textbook problems
Lab Activities -- Complete Lab Experiments
Final Exam -- Multiple Choice Questions, Conceptual Questions, and Symbolic and Numerical Problems
Mid Term -- Multiple Choice Questions, Conceptual Questions, and Symbolic and Numerical Problems

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
Textbook chapters
Laboratory Manual experiments

Sample Reading Assignment 1:
Read Chapter 18 - Kinetic Theory of Gases

Sample Reading Assignment 2:
Read Experiment 11 - The Thermal Coefficient of Linear Expansion

B. Writing Assignments
Complete Laboratory Reports

Lab Report Requirements:

1) Cover Page (Typed): Include Your Name, Lab Exp. #, Lab Title, Date, and list of Lab Partners.

2) Procedure (Typed): In your own words describe the general procedure(s) for this experiment. The procedure can be in an outline format, paragraphs, or any other way that can best convey the procedure used to carry out the experiment, make measurements, and obtain the required results. Please: Do Not Just Copy the Procedure from the Lab Manual.

3) Data Sheet(s) Section: Include your Lab data sheets here that came out of your Wilson Lab Manual or were provided on handouts. This sheet MUST have my initials from the lab. Do Not Forget to include units, correct number of significant figures, and make sure your entries are legible.

4) Graph Section: Any graphs assigned are to be done on the computer with software that includes Regression Analysis by the method of least squares. The regression equation must be printed on the top of the graph. Each graph must be labeled with a Title and Axes description with units. In Lab Graphs MUST have my initials from the lab.

5) Calculations Section: Hand calculations, which includes providing units for each factor, term and results. Any conversions or geometric calculations are to be included. Intermediate calculations are to be provided. Your goal should be to write up your calculations so someone else can understand them. Always start by stating the equation being used and then restate it with all variables replaced with their values and dimensions filled in. Leave pi as a symbol. If the same identical calculations are repeated, you only need to show each result once. Calculation details of average values can be omitted. You will lose points if data and results do not include units. Use a separate piece of paper when needed and label the calculations. Do not try to cram the calculations into the margins or put them in the wrong order.

6) Question Answer Section (Typed): Answers to assigned lab questions must be typed and spell checked. Be sure to include the question number and any reference page number. The question must be restated (typed) followed by your answer.

7) Analysis and Conclusion (Typed): In this section, you must critically analyze your results, experiment procedure, measurement techniques, and include a conclusion that explains if the experiment objectives were met or not. Explain why or why not. You are expected to show clear logic and understanding of the final results and their physical meaning.

The laboratory is a large portion of your PHYS 240 grade. In fact, the lab accounts for 30% of the total grade. Hence, it is important to make sure that you meet the entire requirement on every lab. Please ask for assistance and/or any clarification.

The lab work is done by teams and it is acceptable for students to do analysis together but the laboratory report is to be your own work. Laboratory reports from group members that are identical or essentially identical will be treated as a single report and the points awarded to each member will be graded as one report and the points will be split among the students violating this rule. The very best grade you can get if you do not do your own work is 50%.

You are expected to obtain a copy of the laboratory instructions for each week and study them before coming to the laboratory class. This preparation will enhance your learning experience. In order to encourage you to do your preparation, there will be occasional quizzes covering the procedure for the current lab experiment. It is your responsibility to obtain a copy of the laboratory instructions before you come to the lab. Copies will not be available at the laboratory during the lab session.

C. Other Assignments
Homework Problems

Sample Problem 1:
The 1.20 kg head of a hammer has a speed of 5.5 m/s just before it strikes a nail and is brought to rest. Estimate the temperature rise of a 15 gram iron nail generated by 10 such hammer blows done in quick succession. Assume the nail absorbs all the energy.

Sample Problem 2:
Two resistors when connected in series to a 110 V line use one-fourth the power that is used when they are connected in parallel. If one resistor is 2.0 Ohms, what is the resistance of the other?

7. Required Materials

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

Book #1:

Author:	Giancoli, D.C.
Title:	Physics for Scientists and Engineers with Modern Physics
Publisher:	Pearson Education
Date of Publication:	2008
Edition:	4th

Book #2:

Author:	Knight, Randall
Title:	Physics for Scientists and Engineers: A Strategic Approach
Publisher:	Addison-Wesley
Date of Publication:	2012
Edition:	3rd

Manual #1:

Author:	Wilson, D.P., Hernandez, C.A.
Title:	Physics Laboratory Experiments 8th edition
Publisher:	Cengage Learning

Date of Publication: 01-03-2014

B. Other required materials/supplies.