Master Course Syllabus

Physics 2426

CIP # 40.0801.5403

CIP Area: Physical Sciences

Fall, 2005

Prepared by:

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Bryan Campus / Date

Confirmed by:

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PHYS 2426 – Physics for Engineers II
This course is in the core curriculum

PURPOSE STATEMENT

The purpose of the physics component in the core curriculum is to enable the student to understand the basic concepts of classical physics and to apply that understanding to the analysis of current issues in society.

COURSE DESCRIPTION

A continuation of Physics 2425. Topics covered include fundamentals of electricity, magnetism and an introduction to optics. **Prerequisites:** PHYS 2425 and MATH 2413 **Credit:** four semester hours.

The expanded course description is:

A. ELECTROMAGNETISM
   1) Electric Charge, Coulomb's Law and Electric Fields
   2) Conductors and Insulators
   3) Gauss's Law
   4) Voltage and Electric Potential Energy
   5) Capacitors and Dielectrics
   6) Ohm's Law and Resistance
   7) Equivalent Resistance and Kirchhoff's rules.
   8) RC Circuits
   9) Magnetic Fields and Magnetic Force
   10) Biot-Savart Law and Ampere's Law
   11) Faraday's Law
   12) Displacement Current and Maxwell's Equations
   13) Inductance
   14) RL, LC and RLC Circuits
   15) AC Circuits

B. OPTICS
   1) Electromagnetic Radiation
   2) Polarization
   3) Reflection and Refraction
   4) Geometric Optics
   5) Interference and Diffraction

This is a Core Course in the 42-hour Core of Blinn College; more can be found at www.blinn.edu/corecurriculum/. As such, students will develop proficiency in the following :

A. INTELLECTUAL COMPETENCIES
   1) Critical Thinking: The ability to think and analyze at a critical level.
   2) Computer Literacy: The ability to understand our technological society; use computer-based technology in communication, solving problems, and acquiring information.

B. EXEMPLARY EDUCATIONAL OBJECTIVES
   1) To understand and apply method and appropriate technology to the study of the natural sciences.
   2) To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
   3) To identify and recognize the differences among competing scientific theories.
   4) To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
   5) To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture

C. CURRICULUM PERSPECTIVES
   1) Develop a capacity to use knowledge of how technology and science affect their lives.
   2) Use logical reasoning in problem solving.
   3) Integrate knowledge and understand the interrelationship of the scholarly disciplines.

COURSE OBJECTIVES AND STUDENT LEARNING OUTCOMES

Upon completing this course students should have a grasp of the listed concepts and be able to solve problems using calculus and these physics concepts. Lecture and laboratory work will focus on the following learning outcomes:

Understand electric charge, Coulomb's law and the electric field.

Be able to calculate electric fields by summing over discrete distributions and integrating over continuous distributions.

Understand Gauss's law and be able to use it to calculate electric fields in cases with symmetry.

Understand the distinction between conductors and insulators, and the implications of conductors in electrostatics.

Understand voltage and its relation to electric potential energy and to electric fields.

Understand capacitors and dielectrics. Understand energy stored in capacitors and stored in electric fields.

Understand conduction, resistance and Ohm's law.

Be able to solve for the equivalent resistance (or capacitance) of resistor (or capacitor) networks. Be able to solve Kirchhoff rule problems. Understand RC circuits.

Understand the magnetic fields and the magnetic force on moving charges and currents. Understand permanent magnets and current loops as magnetic dipoles and the torque on dipoles in magnetic fields.

Understand Faraday's law and motional EMF.

Understand Maxwell's displacement current addition to Ampere's law. Understand Maxwell's equations and appreciate their significance.

Understand inductance, energy in an inductor and energy in a magnetic field. Understand RL, LC and RLC circuits.

Understand the fundamentals of AC circuits, including reactance, impedance and phase.

Understand how Maxwell's equations give rise to electromagnetic radiation and properties of electromagnetic radiation.

Understand reflection and refraction of light. Understand the formation of images by mirrors and lenses.

Understand the interference and diffraction of light. Understand polarization of light.

Laboratory work will be chosen to re-enforce the above lecture topics. The student will demonstrate in the laboratory an understanding of the experiment through writing a report that analyzes the data and interprets the results.

By the end of the course the student will maintain a minimum grade of **D** (60%) for completion of the course. This grade will include both lecture and laboratory components.

COURSE REQUIREMENTS

This physics course is a survey of the fundamental concepts of physics as listed above. Therefore all topics in the basic course material should be presented and discussed; along with available supporting laboratory exercises.

GRADING SYSTEM

Three or more major exams covering the lecture material will be given.

A minimum of eight (8) laboratory reports will be completed, per student.

A comprehensive final exam (given during the scheduled periods for final exams) will be given.

Quizzes and/or additional projects may be assigned, as the instructor deems necessary. These projects will be stated in the instructor's course information sheet provided to the students on the first day of class.

OUTCOMES INVENTORY

Methods used to evaluate the effectiveness of this course:

1. Comparison of pre-test and post-test scores. A class average post-test grade of double the class average pre-test grade would be minimum improvement.

2. A 70% success rate [grade of C or better] of students finishing the course. A success rate of 55% would seem excessively low.

3. Less than a 30% withdrawal rate of students from the course, based on the 12th day class roll.

4. Student evaluation and comments on the effectiveness of the course.

    1. Each Intellectual Competency listed above will be evaluated to measure its attainment:

b. To measure critical thinking:

Pre- and post-test or written assignment or exam or quiz involving problem solving.

c. To measure computer literacy:
    1. Laboratory reports or quiz over data taking and analysis by using computer AND
    2. Lab assignments or quiz involving internet/compute simulations.

CALENDAR

The instructor will ensure that the course content is covered in a manner that fulfills the course objectives. The instructor will also provide a Course Information Sheet [per college mandated guide lines] to the students and the administration during the first week of the semester, or the first two days of a summer session. Important details including tentative examination dates and due dates for major assignments must be provided.

The following is an approximate time-line for the introduction of various topics within the course during a full semester:

1) Electric Charge, Coulomb's Law and Electric Fields – 1.5 weeks
2) Gauss's Law – 1.5 weeks
3) Voltage and Electric Potential Energy – 1.5 weeks
4) Capacitors and Dielectrics – 0.5 weeks
5) Ohm's Law and Resistance – 0.5 weeks
6) Equivalent Resistance, Kirchhoff's rules and RC Circuits – 1 week
7) Magnetism – 1.5 weeks
8) Faraday's Law – 1 week
9) Displacement Current and Maxwell's Equations – .5 weeks
10) Inductance – .5 weeks
11) RL, LC and RLC Circuits – 0.5 weeks
12) AC Circuits – 1 week
13) Electromagnetic Radiation – 0.5 week
14) Reflection and Refraction – 0.5 weeks
15) Geometric Optics – 1 week
16) Interference and Diffraction, Polarization – 1 week

MATERIALS

TEXTBOOK:

Bryan and Brenham campus: R.A. Serway and R.J. Beicher: PHYSICS: For Scientists and Engineers, 5th ed., Saunders College Publishing, Fort Worth, TX 2000.

LABORATORY MANUAL:

Bryan campus: none required
Brenham campus: J.D. Wilson: Physics Laboratory Experiments, 5th ed., D.C. Heath and Company, Lexington, MA

OPTIONAL MATERIAL:

Bryan campus: any scientific calculator
Brenham campus: scientific calculator – neither graphing nor programmable; prefer one-line display.