HAROLD WASHINGTON COLLEGE
MASTER SYLLABUS – COLLEGE CREDIT COURSE

1. TITLE, NUMBER, AND CLASSIFICATION:

Name of Course Engineering Physics II
Department Name Physical Science
Number Code 077
Course Number 0236

2. COURSE TERM: 16 Week Semester

3. CREDIT AND CONTACT HOURS:

(i) credit hours 4 (ii) contact hours per week 6 (iii) types of activities

X Lecture/Discussion
X Lab
Clinical/Work Experience
Other

4. PREREQUISITES - if none check here ; otherwise describe below:

"C" or better in Physics 235 and eligibility for English 101 or consent of department chairperson

5. CATALOG DESCRIPTION - write below, as in current college catalog;

Electricity & Magnetism - Emphasizes problem solving involving the use of calculus. Primarily for students majoring in engineering or physical sciences. Writing assignments, as appropriate to the discipline, are part of the course. 2 lecture and 4 lab hours per week

6. STUDENTS FOR WHOM THE COURSE IS INTENDED:

Engineering and other physical science majors.

7. COURSE OBJECTIVES:

The course is to cover:

electric charge, Coulomb's law and electric fields;
Maxwell's equations and their applications;
electric potential and potential energy;
direct current circuits and the classical circuit elements: resistance, capacitance and inductance;
sources of magnetic fields, magnetic forces, magnetic materials, generators and motors;
alternating current circuits;
electromagnetic and mechanical waves, interference, diffraction and polarization;
geometric optics.

8. STUDENT LEARNING OUTCOMES

By means of written responses, drawing diagrams, and solving problems involving calculation, the student will demonstrate the ability to

describe electric charge in terms of charge quantization and transfer of electrons;

calculate electric forces on point charges using Coulomb's law;

describe and calculate the electric fields of point charges, and the force on a charge in an electric field; analyze the motion of a charged particle in a uniform electric field;

use Gauss' law to calculate symmetric electric fields, and relate electric flux through a closed surface to the enclosed charge;

describe electric current and resistance, and use Ohm's law, conductivity, resistivity, and current density in calculations; describe the operation of a battery; add resistances in series and parallel, and analyze circuits using Kirchhoff's laws;

calculate the electric potential of a system of point charges and the potential energy of the system; relate uniform electric fields and differences in electric potential; describe equipotential surfaces and their relation to conductors in electrostatics;

describe sources of magnetic fields, and use the Biot-Savart law and Ampere's law to calculate magnetic fields;

calculate magnetic forces on and resulting motion of point charges; calculate magnetic forces on current-carrying wires; describe the operation of electric motors;

describe electromagnetic induction, and deduce directions of induced currents due to changes in magnetic flux; use Faraday's law to calculate induced currents; describe the operation of electric generators; relate transformer input and output currents and voltages;

calculate the fields of electric and magnetic dipoles, torque and potential energy of a dipole in an external field;

analyze time dependent electric circuits including resistance, capacitance, and/or inductance; analyze alternating current circuits;

describe transverse and longitudinal traveling waves; make use of the mathematical description of harmonic traveling waves and wave pulses, and the quantitative relations between wavelength, frequency and speed of traveling waves;

relate the power of a sound source and the intensity of sound; calculate frequency changes in sound waves due to the Doppler effect;

deduce the possible wavelengths and frequencies of standing waves in a given medium; calculate phase differences between waves from two sources and the resulting interference effects;

relate induced magnetic fields to changing electric flux; make use of the mathematical

description of electromagnetic waves, including the relation between electric and magnetic field magnitudes, the relation between wavelength, frequency and wave speed; relate wavelength and frequency to the mathematical description of harmonic waves;

describe polarization of electromagnetic waves, and relate polarization direction to intensity transmitted through polarizers;

analyze interference patterns of light transmitted through two slits, and through diffraction gratings;

use ray tracing techniques to locate the images produced by plane and curved mirrors, and by thin lenses; use ray tracing techniques to show how images are produced by telescopes and microscopes.

Students will be required to demonstrate laboratory skills in a series of experiments by:

measuring quantities carefully and correctly, including units and uncertainties;
Making calculations from data correctly, including uncertainties in results where required;
recording data and calculations in a clear and organized way, with notes that make their meanings clear;
carefully and correctly plotting required graphs, and obtaining quantitative results from them;
organizing data, calculations, graphs, results and additional written work to clarify them into a clear and literate report on the experiment.

9. TOPICAL COURSE OUTLINE:

Electric charge, Coulomb's law and electric fields;
Gauss' law and its applications;
Electric potential and potential energy;
Electric current and resistance;
Direct current circuits and Kirchhoff's rules;
Capacitors and dielectrics;
Faraday's law,
Self and mutual inductance;
Magnetic forces and fields;
Sources of magnetic fields, and magnetic materials;
Faraday's law, generators and motors;
Alternating current circuits;
Maxwell's equations and electromagnetic waves;
Interference, diffraction and polarization of electromagnetic waves
Geometric optics

10. TEXTS AND MATERIALS USED: List of books and/or materials suggested for this course.

Knight, R. D., Physics for Scientists and Engineers with Modern Physics, vols. 3 and 4, Pearson/Addison Wesley, 2004

Physics 236 Laboratory Manual, written by the instructor and handed out in class

11. AMOUNT OF WRITING REQUIRED:

Ten reports on experiments, approximately three pages each

12. METHODS OF EVALUATION: (Direct and indirect)

Four examinations (75%), ten quizzes (10%), ten reports on experiments (15%)

13. AUTHORIZED SIGNATURE AND FILE DATE:
DEPARTMENT AND CAMPUS **Physical Science Department**
Harold Washington College

5/06