SYLLABUS

Physics 110: Introductory Physics for the Life Sciences
Spring Term, 2015

Dr. Edward A. Roeder, instructor
Office: Room 111, Collier Hall of Science
Office Phone: Extension 1439
Email Address: meear01@moravian.edu
Office hours will be posted on the door of Room 111.

Goals of the Course:

1) To help students develop a conceptual understanding of basic physical principles. Students often tend to focus on finding the correct equation to solve a problem. They fail to see that equations are simply consequences of concepts – concepts that express physical ideas. This course will emphasize how to apply a physical principle to obtain a qualitative solution to a problem. It will provide students with ways of "thinking through" problems before attempting to solve them numerically.

2) To help students understand that physics is an integrated body of knowledge, not simply a collection of isolated facts or topics. A concerted effort will be made to show that in physics, the big picture is one in which a small number of basic ideas are unified so as to present a coherent view of the physical world.

3) To show students that the principles of physics come into play time and time again in their lives. In short, physics is a study of the way nature behaves. This will be clearly illustrated through the reading of selected essays contributed by a number of current physicists. Further appreciation of the presence of physics in our everyday lives will be gained as the students work through the solved examples and then tackle the problem sets at the ends of the chapters.

4) Like other LinC courses in the natural sciences, this course will emphasize the basic elements of the science, involve a study of the quantitative and qualitative aspects of that science, demonstrate change and creativity in science, and address some of the broader implications of science. Through the laboratory component of the course, students will have an opportunity to learn and understand the scientific method.

Required Text:

Essentials of Physics, by John D. Cutnell and Kenneth W. Johnson. John Wiley and Sons, 2006.

Attendance Policy:

Each student is expected to attend all classes in this course. Daily attendance records will be kept. In the event that an exam is missed, a make-up will be given provided that the absence is EXCUSED. If the absence is UNEXCUSED, a ZERO will be recorded for that exam. In order for an absence to be excused, the student must present A) a valid medical excuse signed by a doctor or nurse, or B) an explanatory statement from the Dean of Students verifying that the absence qualifies as "excusable".

Written lab reports will generally be submitted at the end of the laboratory period. Any lab report which is turned in within 24 hours after that time will receive HALF CREDIT. Experiments submitted later than this will automatically be assigned a grade of ZERO. In the event that a student is absent from a laboratory *and* the absence is *unexcused*, no make-up will be permitted and a grade of ZERO will be recorded for that experiment.

In the event that the number of unexcused absences in the course exceeds three (3), one point will be subtracted from the student's final average for each additional unexcused absence following the third.

Policy on Academic Honesty:

The Policy of Academic Honesty to be followed in this course is as follows:

Moravian College expects its students to perform their academic work honestly and fairly. A Moravian student, moreover, should neither hinder not unfairly assist the efforts of other students to complete their work successfully. This policy of academic integrity is the foundation on which learning at Moravian is built.

The College's expectations and the consequences of failure to meet those expectations are outlined in the current Student Handbook, available from the Student Affairs Office, and in the statement on Academic Honesty at Moravian, available from the Academic Dean's Office. If, at any point in a student's academic work at Moravian, a student is uncertain about his or her responsibility as a scholar or about the propriety of a particular action, the instructor should be consulted.

Any student(s) failing to comply with Moravian College's policy of academic honesty will be reported to the Academic Standards Committee.

Policy Regarding Grading:

Grades will be determined as follows:

Quizzes and Exams -50%

Laboratory   -25%

Final Exam   -25%

While grades will be computed by the indicated percentages, it is within the instructor's purview to apply qualitative judgment in determining the final grades for the course.

DISABILITY STATEMENT : Students who wish to request accommodations in this class for a disability should contact Ms. Elaine Mara, Assistant Director of Academic & Disability Support, located on the first floor of Monocacy Hall,

(extension 1401). Accommodations cannot be provided until authorization is received from the Academic & Disability Support Office.

TOPICS TO BE COVERED

Electric Forces and Fields

1) The Concept of the Electric Charge
2) Atoms as the Source of Charge
3) Forces between Charges
4) Insulators and Conductors
5) The Electroscope
6) Charging by Contact and by Induction
7) Faraday's Ice Pail Experiment
8) Conservation of Charge
9) Coulomb's Law
10) The Electric Field
11) The Electric Field of a Point Charge
12) The Electric Field Due to Various Distributions of Charge
13) Conductors in Electric Fields
14) Parallel Metal Plates

Electric Potential
1) Electric Potential Energy
2) Potential Difference
3) Equipotentials
4) Batteries as Sources of Electrical Energy
5) The Electron-volt
6) Absolute Potentials
7) Capacitors
8) Dielectrics
9) The Effects of Dielectrics
10) Capacitors Connected in Series and Parallel
11) The Energy Stored in a Capacitor
12) The Energy Stored in an Electric Field

Direct-Current Circuits
1) Electric Current
2) A Simple Electric Circuit
3) Resistance and Ohm's Law
4) Resistivity and its Temperature Dependence
5) Power and Electrical Heating
6) Kirchhoff's Junction Rule
7) Kirchhoff's Loop Rule
8) Resistors in Series and Parallel
9) Solving Circuit Problems
10) Ammeters and Voltmeters
11) House Circuits
12) Electrical Safety
13) The EMF and Terminal Voltage of a Battery

Magnetism
1) Magnetic Field Mapping
2) The Earth's Magnetic Field
3) The Field Created by an Electric Current
4) The Force on a Current in an External Magnetic Field; The Right-Hand Rule
5) An Extension of the Right-Hand Rule
6) Magnetic Forces on Moving Charges
7) Particle Motion in a Magnetic Field
8) Applications of Magnetic Forces on Charges
9) The Hall Effect
10) Forces between Parallel Currents; The Ampere
11) Magnetic Fields Produced by Currents
12) The Torque on a Current Loop
13) Moving-Coil Meters

Electromagnetic Induction
1) Induced EMF
2) Magnetic Flux
3) Faraday's Law and Lenz's Law
4) Motional EMF
5) Transformers

Electromagnetic Waves

1) Time-Varying Electric and Magnetic Fields
2) Waves from an Antenna
3) Types of Electromagnetic Waves
4) The Speed of Electromagnetic Waves
5) Energy Carried by Electromagnetic Waves

Geometrical Optics : Reflection and Refraction of Light
1) The Concept of Light
2) The Speed of Light
3) The Reflection of Light
4) Plane Mirrors
5) The Focal Length of a Spherical Mirror
6) Ray Diagrams; Image Formation by Concave Spherical Mirrors
7) The Mirror Equation
8) Image Formation by Convex Mirrors
9) The Refraction of Light; Snell's Law
10) Total Internal Reflection
11) Spherical Lenses
12) Ray Diagrams for Thin Lenses; The Thin-Lens Formula
13) Combinations of Lenses

Wave Optics : Interference and Diffraction
1) Huygens' Principle and Diffraction
2) Interference
3) Young's Double-Slit Experiment
4) Interference in Thin Films
5) Diffraction Grating
6) Diffraction by a Single Slit
7) Diffraction and the Limits of Resolution
8) Polarized Light

Optical Devices
1) The Eye
2) Nearsightedness and Farsightedness
3) Corrective Lenses

ASSIGNED PROBLEMS

Chapter 18:   1, 5, 10, 16, 18, 19, 25, 27, 29, 30, 38, 40, 48, 54

Chapter 19:   1, 2, 4, 5, 6, 8, 12, 14, 16, 19, 23, 27, 28, 29, 30, 36, 37, 38

Chapter 20:   2, 5, 7, 10, 13, 17, 18, 23, 24, 39, 41, 46, 49, 53, 57, 58, 61, 63, 67, 68, 73, 74, 76, 77, 86, 87, 88, 94

Chapter 21:   1, 2, 3, 5, 10, 12, 17, 21, 26, 32, 36, 46, 48, 49, 57, 61

Chapter 22:   2, 3, 6, 10, 16, 17, 20, 23, 28, 32, 56, 58

Chapter 24:   2, 8, 9, 12, 14, 15, 31, 35, 38

Chapter 25:   1, 2, 8, 10, 12, 16, 17, 20, 22, 23, 28

Chapter 26:   2, 5, 10, 12, 16, 20, 23, 26, 32, 34, 41, 44, 46, 48, 50, 59, 63, 67, 69

Chapter 27:   1, 2, 5, 10, 11, 15, 19, 21, 38, 39