

## WTCS Repository

10-806-188 Calculus Based Physics 2

# Course Outcome Summary

### Course Information

|  |  |  |
| --- | --- | --- |
|  | Description | This course is a continuation of Calculus Based Physics 1. It is designed to provide a calculus-based approach to the study of physics. Topics include: electric fields, magnetic fields, Maxwell's equations, electromagnetic waves, and optics. Lab activities are related to and support classroom presentations. |
|  | Total Credits | 3.00 |

Purpose/Goals

To give the student a basic understanding of the laws of physics for the topics covered using a calculus approach.

Develop problem solving skills.

Provide a foundation for future courses.

Pre/Corequisites

|  |  |
| --- | --- |
| Prerequisite | Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College. |

### Course Competencies

|  |  |
| --- | --- |
| 1. | Explain the concepts of charge, electric force, and electric fields. |
|  | Assessment Strategies |
|  | 1.1. | through completion of homework. |
|  | 1.2. | through completion of quizzes/exams. |
|  | 1.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 1.1. | you can define the concepts of electric charge and electric fields. |
|  | 1.2. | you can draw electric field lines for simple charge distributions. |
|  | Learning Objectives |
|  | 1.a. | Describe the properties of electric charge. |
|  | 1.b. | Define the eletric field. |
|  | 1.c. | Describe the properties of an electric field. |
|  | 1.d. | Sketch electric field lines. |
|  | 1.e. | Describe the concept of electric flux. |
| 2. | Solve problems involving electric charge, force, fields and Gauss' law. |
|  | Assessment Strategies |
|  | 2.1. | through completion of homework. |
|  | 2.2. | through completion of quizzes/exams. |
|  | 2.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 2.1. | you can select the correct equation(s) to solve the problem. |
|  | 2.2. | you can manipulate the equation(s) to solve the unknown. |
|  | 2.3. | you can substitute the correct values and complete the calculation. |
|  | 2.4. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 2.a. | Solve for the force on a charge using Coulomb's law. |
|  | 2.b. | Solve for the electric field of various charge distributions using the definition of the electric field. |
|  | 2.c. | Solve for the equations of motion for a charged particle in an electric field. |
|  | 2.d. | Solve for the electric flux through various surfaces. |
|  | 2.e. | Solve for the electric field of various charge distributions using Gauss' law. |
|  | 2.f. | Solve for a charge distribution from a given electric field using Gauss' law. |
| 3. | Solve problems involving the concepts of electric potential, current, capacitance, and resistance. |
|  | Assessment Strategies |
|  | 3.1. | through completion of homework. |
|  | 3.2. | through completion of quizzes/exams. |
|  | 3.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 3.1. | you describe the concepts of electric potential, current, and simple circuits. |
|  | 3.2. | you can select the correct equation (s) to solve the problem. |
|  | 3.3. | you can manipulate the equation (s) to solve the unknown. |
|  | 3.4. | you can substitute the correct values and complete the calculation. |
|  | 3.5. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 3.a. | Define electric potential. |
|  | 3.b. | Define electric potential difference. |
|  | 3.c. | Define electric current. |
|  | 3.d. | Describe the concepts of electric potential, current, capacitance, and resistance. |
|  | 3.e. | State Kirchhoff's rules. |
| 4. | Solve problems involving electric potential, current, and simple circuits. |
|  | Assessment Strategies |
|  | 4.1. | through completion of homework. |
|  | 4.2. | through completion of quizzes/exams. |
|  | 4.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 4.1. | you can select the correct equation(s) to solve the problem. |
|  | 4.2. | you can manipulate the equation(s) to solve the unknown. |
|  | 4.3. | you can substitute the correct values and complete the calculation. |
|  | 4.4. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 4.a. | Calculate the electric potential for various charge distributions. |
|  | 4.b. | Calculate the electric field from the electric potential. |
|  | 4.c. | Solve problems involving conductors in electric fields. |
|  | 4.d. | Solve for voltage, current, or resistance using Ohm's law. |
|  | 4.e. | Calculate the resistance of a resistor at various temperatures. |
|  | 4.f. | Solve single loop circuits. |
|  | 4.g. | Solve multi loop circuits. |
| 5. | Solve problems involving the magnetic field. |
|  | Assessment Strategies |
|  | 5.1. | through completion of homework. |
|  | 5.2. | through completion of quizzes/exams. |
|  | 5.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 5.1. | you can decribe the concepts of magnetic fields. |
|  | 5.2. | you can select the correct equation(s) to solve the problem. |
|  | 5.3. | you can manipulate the equation(s) to solve the unknown. |
|  | 5.4. | you can substitute the correct values and complete the calculation. |
|  | 5.5. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 5.a. | you can describe the concepts of magnetic fields. |
|  | 5.b. | you can describe the sources of magnetic fields. |
|  | 5.c. | you can describe the effect of magnetic field on a charged particle. |
|  | 5.d. | Solve for the equations of motion of a charged particle in a magnetic field. |
|  | 5.e. | Solve for the force and torque on various current configurations from a magnetic field. |
|  | 5.f. | Solve for the magnetic field from one of more current configurations (Biot-Savart law and Ampere's law). |
|  | 5.g. | Solve for the induced emf due to a changing magnetic field. |
| 6. | Solve problems involving electromagnetic radiation. |
|  | Assessment Strategies |
|  | 6.1. | through completion of homework. |
|  | 6.2. | through completion of quizzes/exams. |
|  | 6.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 6.1. | you can describe the concepts of electromagnetic radiation. |
|  | 6.2. | you can select the correct equation(s) to solve the problem. |
|  | 6.3. | you can manipulate the equation(s) to solve the unknown. |
|  | 6.4. | you can substitute the correct values and complete the calculation. |
|  | 6.5. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 6.a. | Describe electromagnetic radiation. |
|  | 6.b. | Recognize Maxwell's equations. |
|  | 6.c. | Describe the changes Maxwell made to Ampere's Law. |
|  | 6.d. | Describe the Poynting vector. |
|  | 6.e. | Solve problems using Maxwell's equations. |
|  | 6.f. | Solve for the energy density of electromagnetic radiation. |
|  | 6.g. | Solve for the energy transmitted by electromagnetic radiation. |
|  | 6.h. | Solve for the wave equation, beginning with Maxwell's equation. |
| 7. | Solve problems involving geometric and wave optics. |
|  | Assessment Strategies |
|  | 7.1. | through completion of homework. |
|  | 7.2. | through completion of quizzes/exams. |
|  | 7.3. | through completion of lab activities. |
|  | Criteria |
|  | Your performance will be successful when: |
|  | 7.1. | you can describe the concepts of geometric and wave optics. |
|  | 7.2. | you can select the correct equation(s) to solve the problem. |
|  | 7.3. | you can manipulate the equation(s) to solve the unknown. |
|  | 7.4. | you can substitute the correct values and complete the calculation. |
|  | 7.5. | you include the correct units of measure in your answer. |
|  | Learning Objectives |
|  | 7.a. | Relate electromagnetic radiation to the electromagnetic spectrum. |
|  | 7.b. | Describe polarization. |
|  | 7.c. | Describe superposition principle. |
|  | 7.d. | Describe diffraction and interference. |
|  | 7.e. | Describe image formation from mirrors and lenses. |
|  | 7.f. | Describe total internal reflection. |
|  | 7.g. | Use ray tracing to locate objects, images, and focal points for reflection from plane and spherical surfaces. |
|  | 7.h. | Use ray tracing to locate objects and images for refraction from plane and spherical surfaces. |
|  | 7.i. | Use ray tracing to locate objects, images, and focal points of a thin lens or a combination of thin lenses. |
|  | 7.j. | Solve for the location of objects, images, and foacl points for reflection from plane and spherical surfaces. |
|  | 7.k. | Solve for the location of objects, images, and focal points of a thin lens or a combination of thin lenses. |
|  | 7.l. | Solve for the critical angle. |
|  | 7.m. | Solve for the location of maxima and minima for 2 slit interference. |
|  | 7.n. | Solve for intensity as a function of position for 2 slit interference. |