

## WTCS Repository

# 10-806-182 Forces, Fields and Energy

## Course Outcome Summary

### Course Information

**Description** Forces, Fields and Energy offer an in-depth study of electricity and magnetism, including electrostatics, electric and magnetic field theory, electric circuits and electronics. The course also includes a brief introduction to kinematics, dynamics, work and energy so that they can be applied to electric and magnetic systems. The course concludes with an introduction to wave optics and the wave/particle duality of light and subatomic particles.

**Total Credits** 3.00

### 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. Demonstrate safety procedures and protocols in the laboratory

##### Assessment Strategies

- 1.1. by submitting completed of lab activities

##### Criteria

*Your performance will be successful when:*

- 1.1. you explain the use of safety equipment in the laboratory
- 1.2. you locate the safety equipment in the laboratory
- 1.3. you locate the emergency exit foute from the laboratory
- 1.4. you apply safety procedures in handling high voltages

#### 2. Apply the concepts of kinematics

##### Assessment Strategies

- 2.1. through completion of homework
- 2.2. through completion of quizzes and exams
- 2.3. through completion of lab activities
- 2.4. with the use of a scientific calculator

##### Criteria

*Your performance will be successful when:*

- 2.1. you distinguish between displacement, distance, velocity, speed, acceleration and time
- 2.2. you solve problems involving displacement, velocity, acceleration and time
- 2.3. you show the steps used to solve problems
- 2.4. you include correct units of measure in your answer

### **3. Apply the laws of dynamics**

#### **Assessment Strategies**

- 3.1. through completion of homework
- 3.2. through completion of lab activities
- 3.3. through completion of quizzes and exams
- 3.4. with the use of a scientific calculator

#### **Criteria**

*Your performance will be successful when:*

- 3.1. you apply Newton's laws of motion
- 3.2. you draw an accurate free body diagram representing forces in a problem
- 3.3. you use free body diagrams to solve for unknowns
- 3.4. you solve circular motion problems
- 3.5. you show the steps used to solve problems
- 3.6. you include correct units of measure in your answer

### **4. Apply the concepts of work, energy and power**

#### **Assessment Strategies**

- 4.1. through completion of homework
- 4.2. through completion of lab activities
- 4.3. through completion of quizzes and exams
- 4.4. with the use of a scientific calculator

#### **Criteria**

*Your performance will be successful when:*

- 4.1. you distinguish between work, energy, kinetic energy, potential energy and power
- 4.2. you solve problems involving work
- 4.3. you solve problems involving power
- 4.4. you solve problems involving potential, and kinetic energy and the conservation of energy
- 4.5. you apply energy principles to electrostatic and electrodynamic systems
- 4.6. you show the steps used to solve problems
- 4.7. you include correct units of measure in your answer

### **5. Apply principles of electrostatics**

#### **Assessment Strategies**

- 5.1. through completion of homework
- 5.2. through completion of lab activities
- 5.3. through completion of quizzes and exams
- 5.4. with the use of a scientific calculator

#### **Criteria**

*Your performance will be successful when:*

- 5.1. you solve Coulomb's law problems
- 5.2. you analyze electric fields
- 5.3. you apply electric fields to electron beam deflection
- 5.4. you differentiate between conductors, insulators and semi-conductors
- 5.5. you apply concepts of electric potential and electric potential energy
- 5.6. you show the steps used to solve problems
- 5.7. you include correct units of measure in your answers

### **6. Apply principles of electric current**

#### **Assessment Strategies**

- 6.1. through completion of homework
- 6.2. through completion of lab activities
- 6.3. through completion of quizzes and exams
- 6.4. with the use of a scientific calculator

## Criteria

*Your performance will be successful when:*

- 6.1. you explain the flow of charge
- 6.2. you explain the functioning of circuit elements
- 6.3. you apply Ohm's law
- 6.4. you apply Kirchoff's laws
- 6.5. you analyze circuits
- 6.6. you solve problems involving electric power
- 6.7. you interpret circuit diagrams to build and analyze circuits
- 6.8. you show the steps used to solve problems
- 6.9. you include correct units of measure in your answers

## 7. Analyze magnetic fields

### Assessment Strategies

- 7.1. through completion of homework
- 7.2. through completion of lab activities
- 7.3. through completion of quizzes and exams
- 7.4. with the use of a scientific calculator

### Criteria

*Your performance will be successful when:*

- 7.1. you explain magnetic fields and their source
- 7.2. you apply magnetic force laws
- 7.3. you summarize magnetic force law applications
- 7.4. you apply magnetic fields to electron beam deflection
- 7.5. you apply principles of induction
- 7.6. you explain the functioning of inductors, transformers and generators
- 7.7. you show the steps used to solve problems
- 7.8. you include the correct units of measure in your answers

## 8. Use electronic measurement devices

### Assessment Strategies

- 8.1. through completion of lab activities
- 8.2. through completion of quizzes and exams
- 8.3. with the use of a scientific calculator

### Criteria

*Your performance will be successful when:*

- 8.1. you use a multimeter to measure current in AC and DC circuits
- 8.2. you use a multimeter to measure voltage in AC and DC circuits
- 8.3. you use an oscilloscope to analyze electric signals and circuits

## 9. Analyze electronic systems

### Assessment Strategies

- 9.1. through completion of homework
- 9.2. through completion of lab activities
- 9.3. through completion of quizzes and exams
- 9.4. with the use of a scientific calculator

### Criteria

*Your performance will be successful when:*

- 9.1. you explain the functioning of doped semi-conductors and p-n junctions
- 9.2. you explain the application and functioning of a diode
- 9.3. you summarize the application and functioning of a field effect transistor
- 9.4. you build and analyze AC to DC converters
- 9.5. you use circuit diagrams to construct electronic circuits

## 10. Analyze wave optics

### Assessment Strategies

- 10.1. with the use of a scientific calculator
- 10.2. through completion of homework
- 10.3. through completion of lab activities
- 10.4. through completion of quizzes and exams

### Criteria

*Your performance will be successful when:*

- 10.1. you solve problems involving frequency, wavelength, wave speed and amplitude
- 10.2. you determine characteristics of electromagnetic waves
- 10.3. you explain wave and particle properties of light and electrons
- 10.4. you calculate the deBroglie wavelength of an electron
- 10.5. you analyze interference patterns
- 10.6. you analyze diffraction gratings
- 10.7. you show the steps used to solve problems
- 10.8. you include the correct units of measure in your answers