



South Central College

PHYS 222 General Physics II

Common Course Outline

Course Information

Description	This second course will provide students with the principles of calculus based physics. The course has been designed for students who plan advanced study of science and/or engineering. The course will cover basic principles of waves in light and sound; temperature, heat, and the First Law of Thermodynamics; electric charge; electric fields; Gauss' Law; electric potential; capacitance; resistance; electrical circuits; magnetic fields; induction; electromagnetic oscillations; and Maxwell's Equations; (MNTC 3: Natural Sciences) Prerequisite: Math 132 - Calculus II, with a "C" or better and PHYS 221 General Physics I.
Total Credits	4
Total Hours	80

Types of Instruction

Instruction Type	Credits/Hours
Classroom Presentation	
On Campus Lab	

Pre/Corequisites

Prerequisite	Math 132 - Calculus II with a "C" or better or by instructor permission.
Prerequisite	PHYS 221 General Physics I with a "C" or better.

Course Competencies

1. Demonstrate proper laboratory safety procedures.

Learning Objectives

- Explain a safe workspace envelope.
- Review laboratory safety procedures.
- Demonstrate laboratory safety techniques.

2. Acquire an understanding of waves of light and sound.

Learning Objectives

- Explain types of waves.
- Describe transverse and longitudinal waves.
- Characterize wavelength and frequency.
- Analyze the speed of a traveling wave.
- Analyze wave speed on a stretched string.
- Describe energy and power of a wave traveling along a string.

Acquire an understanding of the wave equation.
Identify basics of the principle of superposition for waves.
Analyze interference waves.
Study standing waves.
Review standing waves and resonance.
Discuss sound waves.
Discuss the speed of sound.
Study traveling sound waves.
Analyze intensity and sound level.
Describe the Doppler Effect.
Study supersonic speeds and shock waves.

3. Study the relationships between temperature, heat and the First Law of Thermodynamics.

Learning Objectives

Define temperature.
Describe how temperature is measured.
Explain thermal expansion.
Obtain a working knowledge of the absorption of heat.
Identify the relationship between heat and work.
Study the Zero and First Law of Thermodynamics.
Summarize heat transfer mechanisms.
Study Ideal Gas Law.
Summarize pressure, temperature, and RMS Speed for a gas.
Study Second Law of Thermodynamics.
Discuss entropy.

4. Demonstrate knowledge of electric charge.

Learning Objectives

Describe an electric charge.
Review characteristics of conductors and insulators.
Discuss and study Coulomb's Law.
Study charges that are quantized.
Study charges are conserved.

5. Explain electric fields.

Learning Objectives

Define an electric field.
Explain electric field lines.
Characterize an electric field due to a point charge.
Characterize an electric field due to an electric dipole.
Study an electric field due to a line of charge.
Study an electric field due to a charged disk.

6. Describe Gauss' Law.

Learning Objectives

Describe and define flux.
Explain Gauss' Law
Obtain a working knowledge of flux of an electric field.
Review Coulomb's Law and relate to Gauss' Law.
Review a charged isolated conductor.
Apply Gauss' Law: Cylindrical Symmetry
Apply Gauss' Law: Planar Symmetry
Apply Gauss' Law: Spherical Symmetry

7. Obtain a working knowledge of electric potentials.

Learning Objectives

Describe electrical potential energy.
Explain equipotential surfaces.
Discuss potential due to a group of point charges.

Discuss potential due to a continuous charge distribution.
Calculate the field from the potential.
Study electric potential of a system of point charges.
Study potential of a charged isolated conductor.

8. Explain capacitance and determine capacitance for a system.

Learning Objectives

Explain capacitance.
Calculate capacitance.
Study capacitors in parallel and in series circuits.
Explain energy stored in an electric field.
Identify capacitors with a dielectric.
Discuss dielectric: an atomic view.
Study dielectrics and Gauss' Law.

9. Describe an electrical current and show an understanding of the relationship to resistance.

Learning Objectives

Explain electric current.
Describe current density.
Acquire an understanding of Ohm's Law.
Describe power in electric circuits.
Study semiconductors.
Identify basics of a superconductor.

10. Draw electrical circuits identifying the current, resistance and voltage of the circuit.

Learning Objectives

Obtain a working knowledge of "pumping" charges.
Identify relationship of work, energy, and EMF (Electromotive Force).
Calculate the current in single-loop circuits.
Explain potential difference between two points.
Investigate multi-loop circuits.
Use ammeter and the voltmeter to analyze electrical circuits.
Discuss RC circuits.

11. Study magnetic fields and give an explanation of what produces a magnetic field.

Learning Objectives

Explain causes that produce a magnetic field.
Review the discovery of the electron.
Characterize the Hall Effect.
Obtain a working knowledge of circulating charged particles.
Review cyclotrons and synchrotrons particle accelerators.
Explain magnetic force on a current-carrying wire.
Describe torque on a current loop.
Study magnetic dipole moment.
Describe force between two parallel currents.
Calculate the magnetic field due to a current.
Study Ampere's Law.
Characterize solenoids and toroids transformers.
Analyze a current-carrying coil as a magnetic dipole.

12. Study induction and electrical energy transfer.

Learning Objectives

Explain Faraday's Law of Induction.
Obtain a working knowledge of Lenz's Law.
Study induction and energy transfer.
Describe induced electric fields.
Review RL circuits.
Explain inductors and inductance.
Discuss energy stored in a magnetic field.

Study energy density of a magnetic field.
Summarize mutual induction.

13. Describe electromagnetic oscillations and the relationship to alternating current.

Learning Objectives

Study LC oscillations, qualitatively.
Study LC oscillations, quantitatively.
Explain damped oscillations in an RLC circuit.
Discuss alternating current.
Study forced oscillations.
Build and analyze three simple circuits.
Describe power in alternating current circuits.
Summarize how transformers function.

14. Demonstrate Maxwell's Equations.

Learning Objectives

Review Gauss' Law for magnetic fields.
Describe induced magnetic fields.
Explain displacement current.
Obtain a working knowledge of Maxwell's Equations.
Study magnetism and relationship to electrons.
Discuss magnetic materials and magnetism of matter.
Review types of magnetism: diamagnetism, paramagnetism, ferromagnetism.