A. INTRODUCTION

A. Fundamental principles of physics, using algebra and trigonometry; the principles and applications of electricity and magnetism, including circuits, electrostatics, electromagnetism, waves, sound, light, optics, and modern physics topics; with emphasis on problem solving.

B. Satisfactory completion of this course earns the student four semester hours credit in college physics required by most colleges of students who plan to major in the natural sciences, chemistry, pre-med or the medical sciences and other majors which require an algebra/trig-based physics course.

C. This course is occupationally related and serves as preparation for the medical school.

D. Prerequisites: PHYS 1401 College Physics I (lecture + lab).

B. LEARNING OUTCOMES

Upon successful completion of this course, College Physics II, the student will be able to:

A. Solve problems involving the inter-relationship of fundamental charged particles, and electrical forces, fields, and currents.

B. Apply Kirchhoff’s Rules to analysis of circuits with potential sources, capacitance, inductance, and resistance, including parallel and series capacitance and resistance.

C. Solve problems in the electrostatic interaction of point charges through the application of Coulomb’s Law.

D. Solve problems involving the effects of magnetic fields on moving charges or currents, and the relationship of magnetic fields to the currents that produce them.

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E. Use Faraday’s and Lenz’s laws to determine electromotive forces and solve problems involving electromagnetic induction.

F. Articulate the principles of reflection, refraction, diffraction, interference, and superposition of waves.

G. Describe the characteristics of light and the electromagnetic spectrum.

III. INSTRUCTIONAL MATERIALS

The instructional materials identified for this course are viewable through www.ctcd.edu/books.

IV. COURSE REQUIREMENTS

A. Reading Assignment:
Specific topics from the textbook will be included in the course outline (Section VIII). Students should read the assigned material for each assigned topic, take notes during the lecture, read the chapter a second time and rewrite notes during this second reading in a way that makes the greatest amount of sense to the student as well as make drawings, if necessary, and critically examine the course material repetitiously multiple days in advance of the exam.

B. Requirements:
Students may want to record the lectures to help master the material. Students will need to provide written answers to end of chapter questions. Students will answer multiple choice questions that are derived from the end of chapter questions. A quiz will be taken at the beginning of class time that will be derived from the aforementioned multiple choice questions. A rule of thumb is to spend 3 hours of study time for every 1 hour of class time.

C. Class Performance:
Students are expected to attend lecture and lab during their scheduled time. If for any reason a student cannot or decides not to complete the course, then it is the responsibility of the student to withdraw from the course prior to the withdrawal date. The Instructor will not withdraw/drop a student from the course at any time. If a student ceases to attend class and does not withdraw from the course, then an appropriate course grade will be submitted at the end of the semester.

If you must be absent from any class meeting, it is your responsibility to find out what happened in class while you were gone. Make friends with one or more other students in class so that you can ask them what happened and secure any
assignments which were given during your absence. Absenteeism is no excuse for not being ready for the current class.

This course, like most science courses, builds on itself. Concepts presented at the beginning of the course will be expanded on and provide the foundation for later material. If you do poorly on any exam, it is important that you go back over the material to be sure that you understand it.

V. EXAMINATIONS

There will be four unit exams given at the times announced. Lowest unit exam score will be dropped. Missed unit exams will not be made up under any circumstances. There will also be a mandatory comprehensive final exam. The final exam cannot be missed – doing so will earn an “F” in the course.

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
<th>Grade Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour exams</td>
<td>60%</td>
<td>90% - 100% = A</td>
</tr>
<tr>
<td>Final exam</td>
<td>10%</td>
<td>80% - 89% = B</td>
</tr>
<tr>
<td>Home work</td>
<td>10%</td>
<td>70% - 79% = C</td>
</tr>
<tr>
<td>Laboratory</td>
<td>20%</td>
<td>60% - 69% = D</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0% - 59% = F</td>
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VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM COURSE INSTRUCTOR

A. Withdrawal from the course: It is the student’s responsibility to officially drop/withdraw from a class if circumstances prevent attendance or if the student decides not to continue with the course and this must be done before the withdrawal date. An instructor cannot initiate a withdrawal based on the student’s request. All students who desire to or must officially withdraw from a course on or after the first scheduled class meeting must file an Application for Withdrawal with the local CTC representative by the last date to withdraw. Students enrolled in distance learning courses and who do not have access to a local CTC representative should submit a withdrawal form to EaglesOnCall@ctcd.edu or the CTC Records Office in Killeen, Texas.

*Applications for Withdrawal will be accepted at any time before the completion of the 12th week of classes for 16-week courses, the sixth week of classes for eight-week courses, or the fourth week of classes for six-week courses.

*For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.

*Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding
agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.

*Students may not withdraw from a class for which the instructor has previously issued a grade of “F.”

B. **An Administrative Withdrawal:** Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College under the following conditions:

   - The student has been placed on Academic Suspension or Disciplinary Suspension;
   - The student has an outstanding financial obligation owed to the college; or
   - The student registered for a course without the required prerequisite or departmental permission.

   The college is under no obligation to refund tuition and fees, or other costs associated with a student who is administratively withdrawn.

C. **An Incomplete Grade:** Incomplete, Course in Progress (for non-developmental courses): An “IP” grade may be assigned by an instructor if a student has made satisfactory progress in a course with the exception of a major quiz, final exam, or other project. The “IP” grade may also be assigned for extenuating circumstances beyond a student’s control such as personal illness, death in the immediate family, military orders, or in the case of distance learning courses, institutional technology failures and mail delays. Notice of absences with supporting documentation may be required by the instructor. The instructor makes the final decision concerning the granting of the incomplete grade. The instructor may set a deadline for completing the remaining course requirements. In no case will the deadline exceed 110 days after the scheduled end of the course. An “IP” grade cannot be replaced by the grade of “W.” If a student elects to repeat the course, the student must register, pay full tuition and fees and repeat the entire course. At the end of the 110 calendar days if the student has not completed the remaining coursework as required by the instructor, the “IP” will be converted to an “FI” and appear as an “F” on the student’s official transcript. A student who merely fails to show for the final examination will receive a zero for the final and a “F” for the course.

D. **Cellular Phones:** Cell phones will be turned off while the student is in the classroom or laboratory. Use of a cell phone during an exam or quiz will result in a zero for that work. If a student, in any way, makes a copy of exam questions, homework or quiz questions – then that student will be dropped from the course with an “F”. The number for your family members to call in an emergency is 254-526-1200.
E. **Americans with Disabilities:** Disability Support Services (DSS) provides support services for students who have appropriate documentation of a disability. Students requiring classroom, academic or other accommodations are responsible for contacting DSS located on the central campus, Building 111, Room 207, (254) 526-1291. This service is available to all students, regardless of location. Reasonable accommodations will be given through DSS in accordance with American with Disabilities Act (ADA) and Section 504 Rehabilitation Act. Additional information from DSS is available at [http://www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support).

F. **Instructor Discretion:** The instructor reserves the right of final decision in course requirements.

G. **Civility:** Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

H. For complete information consult the College Catalog.

**VIII. COURSE OUTLINE**

**A. Electric Charges, Electric Forces, and Electric Fields**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Describe static electricity.
   b. Describe the types of electrical charge.
   c. Describe the ways of producing static charge.
   d. Discuss the structure of the atom.
   e. Discuss the conduction of electricity.
   f. State Coulomb's law and carry out calculations involving this law.
   g. Describe what is meant by the concept of electric field.
   h. Carry out calculations involving electric fields.
   i. Explain the concept of lines of force.
   j. Discuss electric fields in conductors.
   k. Describe the Millikan Oil-Drop experiment.
   l. Operate and explain the function of a Van De Graaff generator.
   m. Determine electrical parameters using an Oscilloscope.
   n. Apply and define the following terms:
B. **Electrical Energy and Capacitance**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Discuss the concepts of electric potential and potential difference.
   b. Distinguish between electric potential energy and electric potential.
   c. Carry out calculations involving electric potential and potential difference.
   d. Discuss the concepts of equipotential lines and equipotential surfaces.
   e. Discuss the electric potential field of a point charge.
   f. Carry out calculations involving work energy and potential.
   g. Relate the concept of potential difference to the work done on a test charge.
   h. Calculate the electric potential due to point charges.
   i. Explain what electric dipoles are.
   j. Determine electric fields from potential difference.
   k. Explain and carry out calculations involving electrostatic potential energy.
   l. Describe the construction and function of capacitors.
   m. Carry out calculations involving capacitance.
   n. Discuss the use of capacitors in series and parallel.
   o. Carry out calculations involving capacitors wired in series and parallel.
   p. Discuss the storage of electric energy by capacitors.
   q. Carry out calculations involving energy storage in capacitors.
   r. Discuss the use of dielectrics.
   s. Carry out calculations involving dielectrics in capacitors.
   t. Define and use the following terms:
      - Electric potential
      - Potential difference
      - Equipotential
      - Voltage
      - Electron volt
      - Capacitor
      - Dielectric
      - Dielectric constant

C. **Electric Current and Resistance**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Discuss the history and explain the basic structure of an electric battery.
   b. Interpret and draw electric circuit diagrams.
   c. Carry out calculations involving electric charge and current.
   d. Explain Ohm's Law.
   e. Carry out calculations involving Ohm's Law.
   f. Explain the concepts of resistivity, conductivity, and superconductivity.
g. Carry out calculations involving resistivity and temperature dependence of resistivity
h. Discuss electric current, current density and drift velocity
i. Carry out calculations involving electric current, current density and drift velocity
j. Discuss the transformation of electric power
k. Carry out calculations involving electric power
l. Use and define the following terms: Anode, Cathode, Electrode, Electromotive force (EMF), Electric current, Resistance, Resistivity, Electric cell, Conductivity Electrolyte, Terminal, Circuit, Resistor, Conductor

D. Direct Current Circuits

1. Learning Outcomes: Upon successful completion of this unit, the student will be able to:
   a. Compare current, voltage, and resistance of resistors in series and parallel circuits.
   b. Carry out calculations involving resistors in series and parallel circuits.
   c. Distinguish between the EMF of a seat of electromotive force and the terminal voltage of the seat.
   d. Carry out calculations involving EMF and terminal voltage.
   e. State and apply Kirchhoff’s rules.
   f. Analyze simple circuits.
   g. Carry out calculations of EMFs in series and parallel.
   h. Discuss current and voltage variations of circuits involving capacitors and resistors.
   i. Carry out calculations involving capacitors and resistors in the same circuits.

E. Magnetism

1. Learning Outcomes: Upon successful completion of this unit, the student will be able to:
   a. Discuss the concepts of magnetism and magnetic fields.
   b. Explain the origin of magnetic field.
   c. Explain the magnetic force exerted on a current in a wire.
   d. Carry out calculations involving magnetic force on electric currents.
   e. Be able to determine the direction of a magnetic force acting on a current-carrying wire.
   f. Discuss the effect of a magnetic field on an electrical charge moving through space.
   g. Carry out calculations involving the motion of an electric charge in
a magnetic field.

h. Describe the discovery and the properties of the electron.
i. Discuss thermionic emission and the cathode ray tube.
j. Discuss the functioning and use of the cyclotron and synchrotron.
k. Explain the construction and use of galvanometers, and loudspeakers.
l. Discuss the Earth’s magnetic field
m. Carry out calculations involving torque on a current loop
n. Describe the magnetic field surrounding a straight wire.
o. Carry out calculations involving magnetic fields of straight wires
p. Apply Ampere’s law to calculate the field surrounding a current-carrying wire of any shape
q. Describe the magnetic field created by a current in a solenoid and a toroid
r. Carry out calculations involving magnetic fields of current-carrying solenoids and toroids
s. Discuss the magnetic force between two parallel wires
t. Carry out calculations involving magnetic force between parallel wires
u. State the operational definition of an ampere and a coulomb
v. Define and use the following terms: North Pole, South Pole, Cathode ray, Magnetic Domain, Right-Hand-Rule, Solenoid.

F. Electromagnetic Induction and Faraday’s Law

1. Learning Outcomes: Upon successful completion of this unit, the student will be able to:
a. Explain induced EMF.
b. Apply Faraday’s Law of induction and Lenz’s Law to calculate induced EMF.
c. Carry out calculations concerning induced EMF in a moving conductor.
d. Discuss the relationship between changing magnetic flux and electric fields.
e. Carry out calculations involving the induction of electric fields by changing magnetic flux.
f. Discuss the structure and functioning of an electric generator.
g. Carry out calculations involving electric generators.
h. Explain counter EMF and torque.
i. Explain eddy currents.
j. Carry out calculations involving counter EMFs and torques.
k. Describe the functioning of magnetic microphones and phonograph cartridges.
1. Define and use the following terms:
Primary coil, Secondary coil, Magnetic Flux, Motional emf, Lenz's law, Generators, Motors, Self-Inductance, Time constant

G. **Alternating Current Circuits and Electromagnetic Waves**

1. **Learning Outcomes**: Upon successful completion of this unit, the student will be able to:
   a. Briefly discuss voltage and current variations in AC circuits.
   b. Describe the effect of having only a resistance in an AC circuit.
   c. Describe the effect of having only a capacitor in an AC circuit.
   d. Describe the effect of having only an inductor in an AC circuit.
   e. Discuss LRC circuits.
   g. Discuss electromagnetic oscillations in LRC circuits.
   h. Carry out calculations involving LC, LR, and LRC circuits.
   i. Carry out calculations involving LRC circuits.
   j. Explain resonance in AC circuits.
   k. Carry out calculations involving resonance in AC circuits.
   l. Describe the structure and use of transformers.
   m. Carry out calculations involving transformers.
   n. Describe, in general terms, Maxwell's argument to explain the production of a magnetic field by a changing electric field.
   o. Carry out calculations involving the production of a magnetic field by a changing electric field.
   p. Discuss the production of electromagnetic waves.
   q. Describe the nature of EM waves.
   r. Discuss the electromagnetic spectrum.
   s. Discuss energy in EM waves.
   t. Carry out calculations involving energy in electromagnetic waves.
   u. Phase angle, rms value, Instantaneous value, Phasor diagram, Impedance, Power factor, Resonance circuits, Transformers, Antenna, Spectrum of electromagnetic waves

H. **Electromagnetic Waves, Reflection and Refraction of Light**

1. **Learning Outcomes**: Upon successful completion of this unit, the student will be able to:
   b. Discuss the speed of light and the historical efforts to measure the speed of light.
   c. Explain reflection of Light.
   d. Describe specular & diffuse reflection.
   e. Discuss refraction of Light.
f. Describe the ray model of Light.
g. Apply the law of refraction.
h. Discuss Dispersion of Light.
i. Carry out calculations involving refraction in a Prism.
j. Discuss total internal reflection and fiber optics
k. Use and define the following terms:
   Angle of incidence, Angle of reflection, Angle of refraction,
   specular reflection, diffuse reflection, Index of refraction,
   Dispersion, Rainbow, Total Internal Reflection, Critical Angle,
   polarization, Malus’ law.

I. Mirrors and Lenses

1. Learning Outcomes: Upon successful completion of this unit, the student will be able to:
   a. Describe image formations in plane mirrors
   b. Understand image formation by spherical mirrors
   c. Carry out calculations involving reflection by plane or spherical mirrors
   d. Use ray tracing to determine the size and location of images
   e. Explain concave & convex mirrors and sign conventions
   f. Discuss refraction at a spherical surface.
   g. Discuss refraction by thin lenses.
   h. Carry out calculations involving refraction by thin lenses.
   i. Discuss lens aberrations.
   j. Carry out calculations involving lens aberrations.
   k. Use and define the following terms:
      Real image, Virtual image, Lateral magnification, Mirror equation,
      Radius of curvature, Focal point, Focal length, Concave, Convex,
      Ray diagrams, Spherical aberration, Magnification.

J. The Wave Optics

1. Learning Outcomes: Upon successful completion of this unit, the student will be able to:
   a. Explain interference of light.
   b. Discuss the conditions for interference
   c. Describe the Young double-slit interference.
   d. Discuss coherence of light.
   e. Discuss interference produced by thin films.
   f. Discuss diffraction of light and carry out calculations involving Diffraction.
   g. Discuss polarization of light.
   h. Use and define the following terms:
Constructive and destructive interference, Thin films, Newton's ring, Diffraction, Polarization, Brewster's angle, Optical activity.

K. **Optical Instruments**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Discuss the construction of a Camera.
   b. Discuss the structure and function of the human eye and the use of corrective lenses.
   c. Discuss the use and functioning of a magnifying glass.
   d. Carry out calculations involving magnifying glasses.
   e. Describe the structure of a compound microscope and how it functions.
   f. Carry out calculations involving compound microscopes.
   g. Describe the structure of a telescope and how it functions.
   h. Carry out calculations involving telescopes.
   i. Explain the resolution of single-slit and circular apertures
   j. Describe Michelson Interferometer.
   k. Describe the diffraction grating.
   l. Use and define the following terms:
      f-number, f-stops, Simple magnifier, Objective, Eye piece, Fresnel lens, Resolution, grating, Resolving power.

L. **Relativity**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Explain relative motion and reference frame.
   b. Discuss the postulates of special theory of relativity.
   c. Explain four-dimensional space-time.
   d. Describe time dilation and length contraction.
   e. Explain Relativistic energy
   f. Use and define the following terms:
      Frame of Reference, Postulates of Relativity, Simultaneity, Time Dilation, The Twin-Paradox, Length contraction

M. **Modern Physics**

1. **Learning Outcomes:** Upon successful completion of this unit, the student will be able to:
   a. Describe the quantum structure of the atom.
   b. Explain the early models of the atom.
   c. State and apply the uncertainty principle.
d. Discuss "bonding" in molecules.
e. Differentiate fusion and fission.
f. Discuss radioactivity.
g. Use and define the following terms:
   Photon, X-rays, Pair production, Wave function, Atomic spectra,
   Electron Clouds, Buckyballs, Lasers, Holography, Compact Disc,
   Isotopes, Binding Energy, Radioactivity.