PHYS 1046
College Physics I

COURSE WEIGHT: 90.00

Course Description
By utilizing an intensive problem-solving approach in the study of physics principles, students will develop the ability to analyze and interpret the relationships of the physical world around them. The student will use the basic principles of physics and mathematics to develop quantitative solutions to both practical and abstract problems. The skills and knowledge gained through this approach will serve as an excellent basis for further study in technology-related college programs.

Course Revision Number
2015.1

Course Development Status
Official

Rationale
The purpose of this course is to provide students with the academic physics skills required for entrance into college or university programs with academic physics pre-requisites such as Computer Electronics Technician, Construction Administration Technology, Heating, Ventilation, Refrigeration & Air Conditioning and Industrial Instrumentation.

Prerequisite(s)
High School Graduation Diploma or equivalent

Corequisite(s)
None

Learning Outcome(s)
Learners are required to successfully complete each course outcome. In keeping with NSCC's approach to portfolio learning, learners will have demonstrated the ability to:

1. Review fundamental math concepts by solving problems including, but not limited to measurement, unit conversion, scientific notation, graphic analysis, formula manipulation, and trigonometric functions, related to physics concepts, that will provide learners with skills to successfully complete the course. (12 hours) – College Physics Chapter 1 and Algebra and Trigonometry Chapters 1 & 2

   Objective(s)
   1. Express measurements in metric units.
   2. Convert metric between units using appropriate metric prefixes.
   3. Convert between metric and imperial units using the factor-label method.
   4. Express numbers using both scientific and standard floating point notation.
   5. Distinguish between accuracy and precision of measurement.
   6. Graph measured data and interpret graphs to analyze measured data.
   7. Perform calculations using, and round numbers to, the appropriate number of significant figures.
   8. Use rounding to estimate an answer to a calculation.
   9. Manipulate formulas to solve for an unknown.
10. Calculate basic trigonometric functions, and give the measured value of an angle from a given value of a trigonometric function.

2. **Apply fundamental principles and theory of mechanics to solve problems in vectors, motion and forces.**

   **College Physics Chapter 2, 3 & 17**

   **Objective(s)**

   1. Vectors – 12 hours **College Physics Chapter 2**
      - Distinguish between vector and scalar quantities.
      - Represent vectors graphically, indicating orientation using degrees or compass bearings.
      - Add vectors graphically and resolve vectors into components using graphical methods.
      - Add and resolve vectors using the mathematical method.
      - Solve equilibrium problems.

   2. Motion - 18 hours
      - Solve problems relating position, displacement, distance, speed, and time.
      - Calculate average velocity of a uniformly accelerated body.
      - Solve problems relating acceleration, velocity and distance.
      - Apply the acceleration concept to free-fall problems.
      - Solve projectile motion problems.

   3. Forces – 18 hours -- **College Physics Chapter 4**
      - List examples of Newton's Three Laws of Motion and solve problems using Newton's Laws as appropriate.
      - Distinguish between mass and weight.
      - Calculate force, given mass.
      - Calculate force of friction, using the normal force, and coefficient of static friction or coefficient of kinetic friction.
      - Summarize the advantages and disadvantages of friction.
      - Calculate components of angular forces.
      - Solve problems involving inclined planes.
      - Calculate torques.
      - Apply equations for centripetal force, acceleration and universal gravitation in solving problems.
      - Solve problems relating mass, velocity, and momentum, and changes in linear momentum.
      - Solve problems involving the Law of Conservation of Linear Momentum.
      - Solve problems involving elastic and inelastic collisions.

3. **Recognize practical applications and solve problems related to fundamentals of work, energy and simple machines.** (12-18 hours) -- **College Physics Chapter 7**

   **Objective(s)**

   1. Distinguish between work and energy.
   2. List sources of energy.
   3. Calculate work \( W = Fd \cos \theta \).
   5. Calculate potential and kinetic energy.
   6. Solve problems involving the relationship(s) between energy, work, and power.
   7. Solve simple and compound machine problems.
   8. Calculate ideal and actual mechanical advantage for the various simple machines.
   9. Define and calculate efficiency.
Suggested Activities

https://ournscc.nscc.ca/sites/GEAS/Physics/default.aspx

Required Textbook(s) and Resources
The official textbook listing for this course can be found in Related Information located at:

https://ournscc.nscc.ca/Schools/Access/Curriculum/Pages/2016-17_Programs.aspx
PHYS 1047

College Physics II

COURSE WEIGHT: 90.00

Course Description
By utilizing an intensive problem-solving approach in the study of physics principles, the student will develop the ability to analyze and interpret the relationships of the physical world around them. The student will use the basic principles of physics and mathematics to develop quantitative solutions to both abstract and practical problems that may be encountered in a work environment. The skills and knowledge gained through this problem-solving approach will serve as an excellent basis for further study in many technology-related college programs.

Course Revision Number
2015.2

Course Development Status
Official

Rationale
The purpose of this course is to provide students with the academic physics skills required for entrance into college or university programs with academic physics pre-requisites such as Architectural Engineering Technician, Electrical Engineering Technology, Electronic Engineering Technology, Mechanical Engineering Technology, Power Engineering Technology, and Civil Engineering Technology.

Prerequisite(s)
PHYS 1046 (College Physics I) or successful completion of RPL assessment

Corequisite(s)
None

Learning Outcome(s)
Learners are required to successfully complete each course outcome. In keeping with NSCC’s approach to portfolio learning, learners will have demonstrated the ability to:

1. Describe fundamental principles of electricity, and use these principles to successfully complete related problems. (30 hours) -- College Physics Chapter 18, 19 & 21

   Objective(s)
   1. Explain the how the structure of the atom gives rise to electrical charge, and the properties of electrical conductors and electrical insulators. (Chapter 18)
   2. Demonstrate properties and applications of static electricity. (Chapter 18)
   3. Describe the processes of charging by conduction and by induction. (Chapter 18)
   4. Describe the distribution of charge on a conductor. (Chapter 18)
   5. Describe the construction and operation of a simple electroscope. (Chapter 18)
   6. Diagram the electrostatic fields which exist in the region surrounding positive point charge, a negative point charge, and combinations of static charges. (Chapter 19-21)
   7. Use Coulomb’s Law to calculate electrical force. (Chapter 19-21)
   8. Solve problems using the equation E=F/Q. (Chapter 19-21)
   9. Use the equation V=?E/Q to solve electric field problems. (Chapter 19-21)
10. Perform calculations involving Ohm’s Law.
11. Draw schematic diagrams of series and parallel circuits.
12. Solve for unknown current(s), voltage(s), etc. in series, parallel, and simple combination circuits, using Kirchhoff’s Current Law and Kirchhoff’s Voltage Law.
13. Describe the factors affecting resistance in a conductor.
14. Use electrical meters to measure voltage, current, and resistance.
15. Identify the functions of fuses, circuit breakers, and ground wires.
16. Distinguish between alternating current and direct current.
17. Explain the differences between electron current flow and conventional current flow.
18. Solve problems requiring the calculation of power.
19. Use the equations:
   \[ P = VI \]
   \[ P = I^2R \]
   \[ P = \frac{V^2}{R} \]
   \[ P = \frac{E}{t} \]
20. Calculate electrical energy using \( E = Pt \) and \( E = VIt \).
21. Calculate the costs of electrical energy used (given utility rate).
22. Describe a typical electrical energy distribution network.
23. Describe the factors affecting power loss in the distribution of electricity.

2. **Describe fundamental principles of magnetism, and use these principles to successfully complete related problems. (18 hours) – Chapters 22, 23 & 24**

   **Objective(s)**

   1. Sketch the magnetic fields around a bar magnet, a horseshoe magnet, two like poles, and two unlike poles.
   2. Describe the magnetic effects of electricity.
   3. Describe the construction of an electromagnet, and the factors that affect its strength.
   4. Determine the orientation of a magnetic field around a current carrying conductor or coil.
   5. Describe effects of magnetic forces on moving charges.
   6. Describe the principles behind the operation of a common d.c. electric door bell.
   7. Explain the principles and applications of electromagnetic induction and Lenz’s Law.
   8. Explain the principles of converting mechanical energy to electrical energy as the apply to a.c. and d.c. generators.
   9. Solve problems involving transformers using the relationships:
      \[ V_s = N_s = I_p \]
      \[ V_p = N_p = I_s \]
   10. Investigate the efficiency of a typical transformer using the relationships:
       \[ P_s = I_s = V_s \]
       \[ P_p = I_p = V_p \]
3. **Explain the elementary laws of fluid mechanics. (12 hours)** – *College Physics Chapters 11 & 12*

   **Objective(s)**
   1. Describe the properties of fluids and explain the differences solids & fluids and liquids & gases.
   2. Describe surface tension and its application to capillarity.
   3. Perform calculations using the density formula and the pressure formula(s).
   4. Apply Archimedes’ Principle to objects immersed in a fluid.
   5. Describe applications of Bernoulli’s Principle.
   6. Apply Pascal’s Principle to hydraulic devices.

4. **Demonstrate a basic understanding of thermodynamics. (12 hours)** – *College Physics Chapters 13, 14 & 15*

   **Objective(s)**
   1. Explain the kinetic molecular theory of heat, and its application to understanding superconductivity.
   2. Compare the Fahrenheit, Celsius, and Kelvin scales and measure temperature of given substances.
   3. Describe heat transfer and the factors that affect the rate of heat transfer for each heat transfer method.
   4. Calculate the quantity of heat loss or gained with a given change in temperature.
   5. Draw a graph of temperature versus heat for water as its temperature is increased from below the freezing point to above the boiling point showing changes of state.
   6. Perform calculations using the relationship heat loss=heat gain.
   7. Perform calculations using the latent heat of fusion and latent heat of vaporization of water.
   8. Demonstrate linear and volumetric expansion and contraction.

5. **Describe the fundamental wave characteristics of sound and light. (Optional)** – *12 hours* – *College Physics Chapters 16, 17 & 24*

   **Objective(s)**
   1. **A. Waves. (Chapter 16)**
      - Describe and determine the force and energy in elastic spring.
      - Compare simple harmonic motion and motion of a pendulum.
      - Identify and compare different waves characteristics.
   2. **B. Sound. (Chapter 17)**
      - Demonstrate the properties that sound shares with other waves.
      - Identify applications of the Doppler Effect.
   3. **C. Light. (Chapter 24)**
      - Predict and solve problems involving illuminations and the speed of light.
      - Predict the effect of combining colors of light and mixed pigments.
   4. **D. Reflection, refraction. (Chapter 25, 26, 27)**
      - Explain the law of reflection.
      - Predict the locations of images formed by mirrors.
      - Solve problems related to curved mirrors.

**Suggested Activities**

https://ournscc.nscc.ca/sites/GEAS/Physics/default.aspx

**Required Textbook(s) and Resources**

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