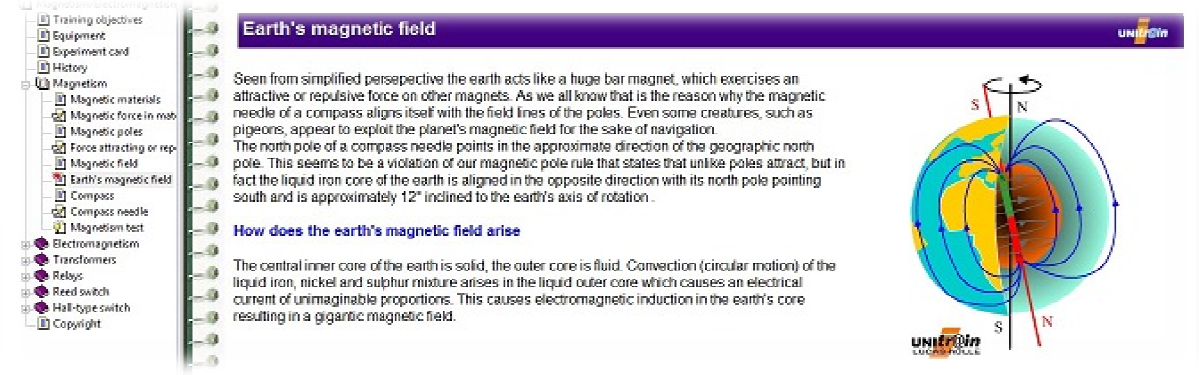
1.45 UniTrain-I (Magnetism / Electromagnetism Course)

Dimitris Polymatidis - SETApps



Short Description:

*E*xperiment-based multimedia *training courses.*
Knowledge of the topic "Magnetism and Electromagnetism" is conveyed in both theory and practice.
Experiment-based investigations with magnets, coils and other essential components are the focal point in conveying how these operate, respond and function.

Aims:

To encourage experiment-based multimedia *training* on the objectives:

- Investigation of permanent magnets and magnetic materials
- Investigation of magnetic force
- Analysis of magnetic poles
- Measurement of magnetic field of a current-carrying conductor
- Explanation of field intensity and magnetic flux
- Investigation of field lines
- Recognizing and explaining the difference between an air-core coil and a coil with ferrite core
- Describing magnetic fields and coils
- Describing detect and verify remanence
- Explanation of electromagnetic induction
- How induction works with a conductor in motion and a core in motion
- Effects of switching an inductor on and off
- Explanation of the Lorentz force
- Analysis and explanation of the operating principle and design of a transformer
- Understanding relays
- Exploring reed switch operation and their use
- Understanding the principle of latching
- Assembly of a latching control circuit and its operation

- Understanding Hall sensor function and introduction to the application circuit

Fostered Skills:

- Students acquire knowledge in both theory and practice.
- Students acquire necessary skills through inquiry and exploratory research designed to give them essential components to investigate how magnets and coils operate, respond and function.

Connection to the curriculum:

Magnetism and Electromagnetism

Implementation of the Demonstrator:

1st learning activity (Orienting & Asking questions).
This activity sets out what topics students will be able to investigate with the UniTrain-I Courses: Magnetism, Electromagnetism, Transformers, Relays, Reed Switch, Hall-type Switch.

2nd learning activity (Hypothesis & Design - Orienting & Asking questions)
The activity focusing upon not only what topics students will be able to investigate with the UniTrain-I Courses, but also what multimedia experiments/tasks will help students to study these topics better:

Magnetism: *Magnetic materials, Magnetic force in materials, Magnetic poles, Force attracting or repelling two magnets, Magnetic field, Earth's magnetic field, Compass, Compass needle, Magnetism assessment test.*

Electromagnetism*: Magnetic fields surrounding electrical conductors, Conduction and magnetic fields experiments 1 and 2, Magnetic field of a coil, Demonstrating a coil's magnetic field, Coil with ferrite core, Effect of the ferrite core, Applications for electromagnetism, Effect of magnetic force, Hysteresis, Soft and hard magnetic materials, Remanence experiment, Lorentz force, Right-hand rule, Induction, Induction experiments 1 and 2, Electromagnetism assessment test.*

Transformers*: Transformer principle, Operating response, Transformer with/without core, Transformation ratio, Transformer under load, Transformer assessment test.*

Relays*: Principle of operation, Relay switching, Free-wheeling diode, Induction spikes, Latching operation, Latching experiment, Relay assessment test.*

Relays switch*: Principle, Reed switch experiment, Reed switch assessment test.*

Hall-type switch*: Principle of a Hall-type switch, Hall switch experiment, Hall switch assessment test.*

3rd learning activity (Planning & Investigation)
The teacher can use multimedia worksheets to support hypotheses that the students should investigate. These worksheets contain a selection of activities for training on Magnetism and Electromagnetism.

An information section provides teachers with curriculum that promotes STEM learning and integration through extensive use of projects / problems, and is tied to learning objectives.

4th learning activity (Analysis & Interpretation)
Students can make use of complete experiments with step-by-step assembly instructions, and measuring instruments in simulation mode.

The teacher can use theinformation section and supporting material for each experiment with complete directions for setting up experiments and helpful hints.

5th learning activity (Conclusion & Evaluation)
An online assessment test is provided at the end for each course.
The teacher can test the answers of the students.
The teacher could also discuss with the students to identify if any improvement on their work is possible and determine whether the learning goals are achieved.

Domain:	**Big Idea of Science:**	**Age group:**	**Time needed:**
Science, Fundamental Physical Principles	3;4	12-15 15-18	1 - 2 hours per course
Languages available:	**Equipment needed**	**Involved actors**	**Used eTool and link:**
English	A personal computer or a laptop	Teachers	UniTrain-I, https://docs.google.com/file/d/0B-JIGA25ExZ8QnliVk9qWVQwMXc/edit?pli=1 Enter the transfer ID **27a2752791** and the password **M$3S!0gn** to access the files provided.

Quality Characteristics of the Demonstrator

Characteristic I
how Demonstrator follows an **inquiry based approach**

Students acquire knowledge about Magnetism and Electromagnetism through inquiry and exploratory research designed to give them e-tools to investigate a topic.

Characteristic II
how Demonstrator integrates **eLearning element**

UniTrain-I is a multimedia e-learning system with integrated, mobile electronics lab for general education and advanced training in electrical engineering and electronics.

Characteristic III
how Demonstrator follows a **Big Idea of Science**

The Unitrain-I system inspire students to learn that:

- *The total amount of energy in the Universe is always the same but energy can be transformed when things change or are made to happen.*
- *Changing the movement of an object requires a net force to be acting on it.*

Characteristic IV
how Demonstrator is connected to a **real world problem**

The Unitrain-I system provides a fun and creative way to explore technology and enables students to take responsibility for 'learning something' by themselves.

Experiences with the Demonstrator?

- *Where? In more than 5 countries*
- *When? Since 2010*
- *How many learners involved? TBC*
- *Results available? TBC*