

CTY
Electrical Engineering
Syllabus

Week 1

Lesson 1

Theory of Solids

- atomic theory /conductors, insulators, electrical charge
- behavior of charged objects
- gravitational and electric fields

Experiments: 1. Conductivity of Materials
2. Magnetic Field around bar magnets

Lesson 2

Energy Concepts

- work, energy, potential and kinetic energy
- principle of conservation of energy

Experiment: Begin disassembly of VCRs

Lesson 3

Electrical circuits (I)

- conversion of metric units
- voltage, current and resistance
- energy transfer in electric circuits
- series circuits
- parallel circuits
- resistor color coding
- work, energy and power in electrical circuits

Experiment: Mapping Electric Fields

Lesson 4

Test #1

Electrical Circuits (II)

- DC circuit analysis
- capacitors and the storage of energy
- common circuit symbols
- schematic diagrams
- series/parallel circuits

Experiment: Series and Parallel Resistors

Lesson 5

Analysis of specialized circuits

- charging and discharging capacitors
- principles of solar cells
- transistors as switches
- discussion of “the water engine”
- discussion of “the solar engine”

Experiment: Lab cleanup and parts acquisition

Week 2

Lesson 1

Electronic Devices

- n- and p- type silicon
- diodes – forward- and reverse-biased
- voltage drops and voltage rises in a circuit
- role of the time constant in charging and discharging capacitors
- Review schematic of solar engine
- Introduction to breadboarding
- design of “Flag Waver” (Robot #1) *(see appendix)

Experiment: Breadboarding Circuits

Lesson 2

Electricity/Electronics

- alternating current/direct current properties
- video: Miniature Miracle: The Computer Chip
- introduction to circuit boards

Experiment: Troubleshooting and completion of Robot #1 circuitry
Preparation and etching of circuit board

Lesson 3

Electromagnetism (I)

- the similarities between electric and magnetic forces
- the magnetic field outside a straight conductor
- the magnetic field inside a coil

Experiment: Construction of Robot #1.

Lesson 4

Test #2

Electromagnetism (II)

- uses of electromagnets
- circuits of lifting magnet, relay and electric doorbell.

Experiment: Project completion/ Introduction of Solar-Powered Racer.

Lesson 5

Robotic Circuits (II)

- breadboarding and operation of basic circuit

Experiment: Construct integrated circuit solar-powered racer.

Week 3

Lesson 1

Electromagnetism (III)

- electromagnetic induction
- historical background
- using magnetic fields to produce current
- Lenz' Law
- practice examples

Troubleshooting: modifications of existing designs, all projects completed, tested and working.

Lesson 2

Review, sample problems
Introduction to the transformer

Robot Circuits (III)

- Introduction to Robot #3: Theory and construction.

Experiment: Breadboard and troubleshoot Robot #3.

Lesson 3

Test #3
Construction of Robot #3

Experiment: Construction of Robot #3

