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Battery Operated Flashlight

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Type:	Design Problem
Student time:	2 weeks
Location:	Take home

Summary

This problem is intended to be used with first year engineering students in the first week or two of classes as an introduction to some aspects of engineering design. Students work individually to produce drawings and component specifications for all parts in a flashlight. An electrical schematic should also be produced along with some elementary analysis of the electrical parameters.

In a follow-up exercise, students should submit a sketch for either of two original designs for a flashlight. Either a black box type design, enhancing the consumer's (and users) interest and curiosity, or a design which is clearly a flashlight with features and functions obvious to the user.

ABET Descriptors

Engr. Sci Content:	First Year Engineering, circuits, electronics
Type:	Component, system
Elements:	Synthesis, evaluation, design
Features:	Design methodology, creativity
Constraints:	Time, aesthetics
Effort:	Individual

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Students shall work independently on the project.

Reverse engineering:

You are to dismantle into individual component parts a battery operated flashlight.

Each component of the flashlight is to be given a name related to its function, e.g. battery housing, dry cell, bulb, reflector etc. These names are to be listed on a component list along with the quantity and material the component is made from.

Each component is to be sketched to scale on a drawing and dimensions included.

A circuit diagram showing all electrical components of the flashlight is also to be submitted.

Design requirements:

Choose either one of the following original design problems :

- A black box design flashlight is to be produced. Your design should **not** look like a flashlight. It should enhance the users interest and curiosity in how it operates. A sketch of the design is required.

- Alternatively, a second design, that is very clearly a flashlight with all functions obvious to the user.

Project deliverables

The reverse engineering of the flashlight should be completed before the beginning of class in week 2 to facilitate a discussion session. The original designs are to be ready for peer review at the beginning of class in week 3 when all material for this project will be submitted.

Evaluation criteria

Report including schematics, component list and suitable quality sketches of flashlight.
Originality of new design including suitable quality sketches.

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Engineering Notes:

This is an independent project engaging the students in a hands on activity on an everyday product that has many varied forms available in the market place.

The non-destructive dismantling of the flashlight into component pieces should be readily accomplished in simple designs, but in some cases may be more difficult, eg. the switch mechanism may not be removed without destroying it.

In most cases the student will identify materials as generic names such as plastic or metal. In these cases, students should be encouraged to identify further the type of plastic or metal used and why during the following week.

The engineering sketches should be assessed in terms of the information content they deliver rather than the detailed (but necessary) requirements such as borders and title blocks, these requirements can be refined later in the course. The sketch should show the component to scale with dimensions. Samples of manufacturers documentation could be used to help the students identify for themselves any inadequacies in their submissions later.

The electrical circuit and analysis should demonstrate their competencies with electrical units such as volts and watts, but may also include amps, ohms and lumens. Battery, switch and bulb life could also be discussed.

The design elements are included to inspire creativity and imagination. Most will believe the exercise seemingly trivial until they become further involved. Manufacturability, cost, safety, product lifetime, customer surveys, operating features, human factors and other aspects of design should be included in discussion.

Intended learning outcomes for students from this project include:

Introduction to reverse engineering and circuits in electrical engineering science.
Introduction to engineering materials, processes, documentation and drawing.
Application of analysis skills to a problem in a physical context.
Development of synthesis skills in designing a product for an open-ended specification.
Exposure to best practice PCB layout and assembly techniques for safety and reliability.