University of Toronto
Faculty of Applied Science and Engineering
APS112 and APS113 Engineering Strategies and Practice

Quiz #1 February 12, 2016

This is a 50-minute quiz. The quiz is closed book and closed notes. The quiz has a total of 19 questions, worth 30 marks. The questions are divided between two booklets.

Question Booklet #2 – Short-Answer Question Booklet

First Name:																										
Last Name:																										
UTOR Email:																										

@mail.utoronto.ca

There are 4 short-answer questions, worth 15 marks in total. These must be answered in the spaces provided in this Short-Answer Question Booklet. This question booklet, with your name and UTOR Email filled in, must be returned along with the multiple-choice answer sheet. Do not separate any pages. Do not write on the QR code at the top of the pages.

We are not looking for long paragraph answers. Use the spaces provided on the question paper to write your answers in short sentences or bullet points for Questions 16-19. (Questions 1 to 15 are found in the multiple-choice question booklet.)

All short-answer questions refer to the following problem statement and figure:

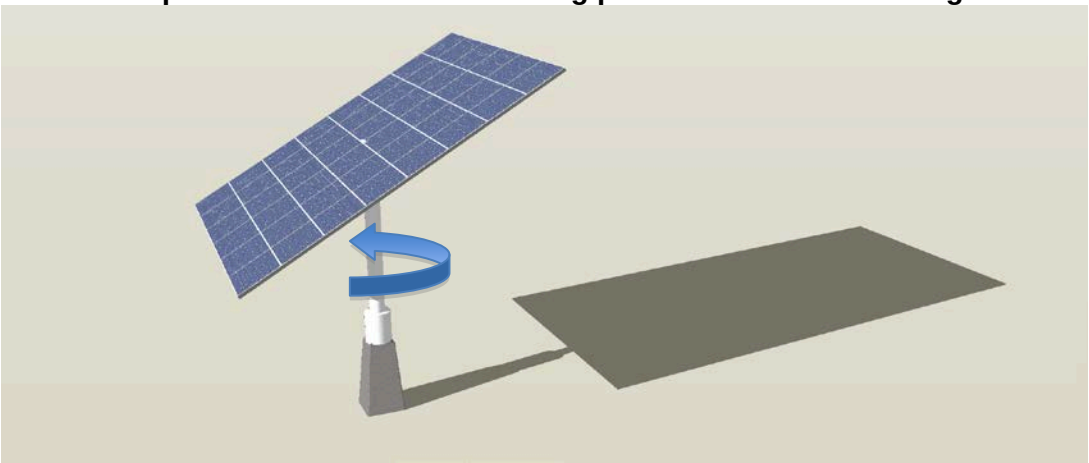

Figure 1: This is a solar panel on a vertical post. It can rotate around a vertical axis at the base of the post. There is very little friction, so it would be easy for a person to rotate the panel by hand.
(Figure based on a Sketchup model Solar Tree 1.0 uploaded by Simon V. on 12/13/13 to the 3d warehouse at 3dwarehouse.sketchup.com)

You are designing an ultra-low-cost **tracking system** to rotate a solar panel to follow the sun from morning to night. (You are not designing the panel or post. The solar panel already exists and is mounted on a post with a freely rotating base.)

A typical commercial tracking system has sensors and motors and is computer controlled. You need to design a mechanical system that can be set in motion by a human each morning, and will approximately follow the sun during the day with no further human assistance. The target market is remote and isolated communities in northern Bangladesh that have no access to power, and have a low level of technological development.

16. (4 MARKS) List ONE Function, TWO important objectives and ONE important constraint for the design.

FUNCTION:
1)

OBJECTIVES:
1)

2)

CONSTRAINT:
1)

17. (2 MARKS) When designing the tracking device, you are asked to draw on **analogies** to provide ideas. Provide a useful analogy, and explain what type of analogy it is and how it is relevant to the current problem.

18. (4 MARKS) One solar panel generates 100 W (1 Watt = 1 J/s) at noon during full sunshine. In the village, solar energy is stored in batteries and used after dark only to provide light for reading and other nighttime activities.

    In the space below, estimate how many solar panels are needed for a village of 1000 people in a remote and underdeveloped part of northern Bangladesh. You must compute an actual number, and show the steps used in making your estimate. Most of the marks will be assigned for showing that you know how to do such a calculation.
    Do all calculations using Watt-hours (Wh) as your unit of energy.

    Useful Information: A bright LED flashlight needs 4W of power.

19. (5 MARKS) IN THE SPACE BELOW, provide a Functional Decomposition of the required tracking device, propose some viable solutions for the main subfunctions, and propose an overall solution.

Do NOT write on this page