

University of Toronto
Faculty of Applied Science and Engineering
APS112 and APS113 Engineering Strategies and Practice
Quiz #1 February 14, 2017

This is a 50-minute quiz. The quiz is closed book and closed notes. The quiz has a total of 23 questions (20 multiple-choice and 3 short-answer questions), worth 41 marks. The questions are divided between two booklets.

Question Booklet #2 – Short-Answer Question Booklet

[illegible]

There are 3 short-answer questions, worth 21 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 with the multiple-choice answer sheet slipped inside. 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 short sentences or bullet points.

All short-answer questions refer to the following client statement.

Client Statement #2 – Photovoltaic Cells

Performance of photovoltaic systems greatly degrade as dust and dirt adhere to the panels. As a result, water based washing systems have been developed to clean photovoltaic systems. Unfortunately, many locations which are suitable to photovoltaic systems have limited water availability (sunny skies means no rain). Design a water efficient method for keeping large photovoltaic power systems clean.



Figure 1: Cleaning of 200 W Photovoltaic Panels by Brian Kusler
(<https://www.flickr.com/photos/briankusler/2447511232/in/photostream/>)

1. (7 MARKS) Give ONE primary function, TWO important objectives, and ONE important constraint for Client Statement #2 – Photovoltaic Cells. Metrics are required for the objectives and constraint, but you do not need to include goals or limits.

PRIMARY FUNCTION:

OBJECTIVE 1:

Metric:

OBJECTIVE 2:

Metric:

CONSTRAINT:

Metric:

2. (7 MARKS) While designing a solution for Client Statement #2 – Photovoltaic Cells, you need to know the amount of water consumed washing panels at the 550 Megawatt (MW) Desert Sunlight Solar Farm in the Mojave Desert. If the panels are washed twice a week in the traditional way, estimate the annual water consumption for this task in Litres. Use reasonable assumptions based on your personal knowledge and the information provided here. You don't have to get an exact answer, but you do have to compute a number and **demonstrate structured thinking**.

3. (7 MARKS) Given Client Statement #2 – Photovoltaic Cells, provide a Functional Decomposition of the cleaning device.
- a. In your Functional Decomposition identify the Primary Function, three subfunctions, and at least one viable solution for each subfunction.
 - b. Use these viable solutions to propose an overall solution.