University of Toronto, Faculty of Applied Science and Engineering
APS112 & APS113 Engineering Strategies and Practice
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Question Booklet #2 – Short-Answer Question Booklet
Midterm Examination: March 29, 2018, 6:15 pm - 7:45 pm

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Instructions:

- This is a 90-minute midterm with a total of 40 questions.
- It is multiple choice AND short answer.
- It is closed book and closed notes. No aids are permitted other than a translation-only paper dictionary.
- The questions are divided between two separate booklets.
    - Question Booklet #1 – Multiple Choice Question Booklet
    - Question Booklet #2 – Short-Answer Question Booklet
- Ensure you have both booklets and a multiple choice answer sheet (scan sheet).
- At the end of exam, hand in short-answer question booklet and multiple choice answer sheet. You don't have to hand in the multiple choice question booklet.

This booklet contains 3 short-answer questions, worth 14 marks in total. Short-answers 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.

38. (5 MARKS) You are part of a team that has been asked to design a new street light (Figure 6). The client only wants to replace the lighting fixture itself, not the pole on which it is mounted. You have to figure out the maximum weight of the new fixture so that it can be safely installed. On the next page sketch a diagram that you would use to clarify your understanding of the physical system.

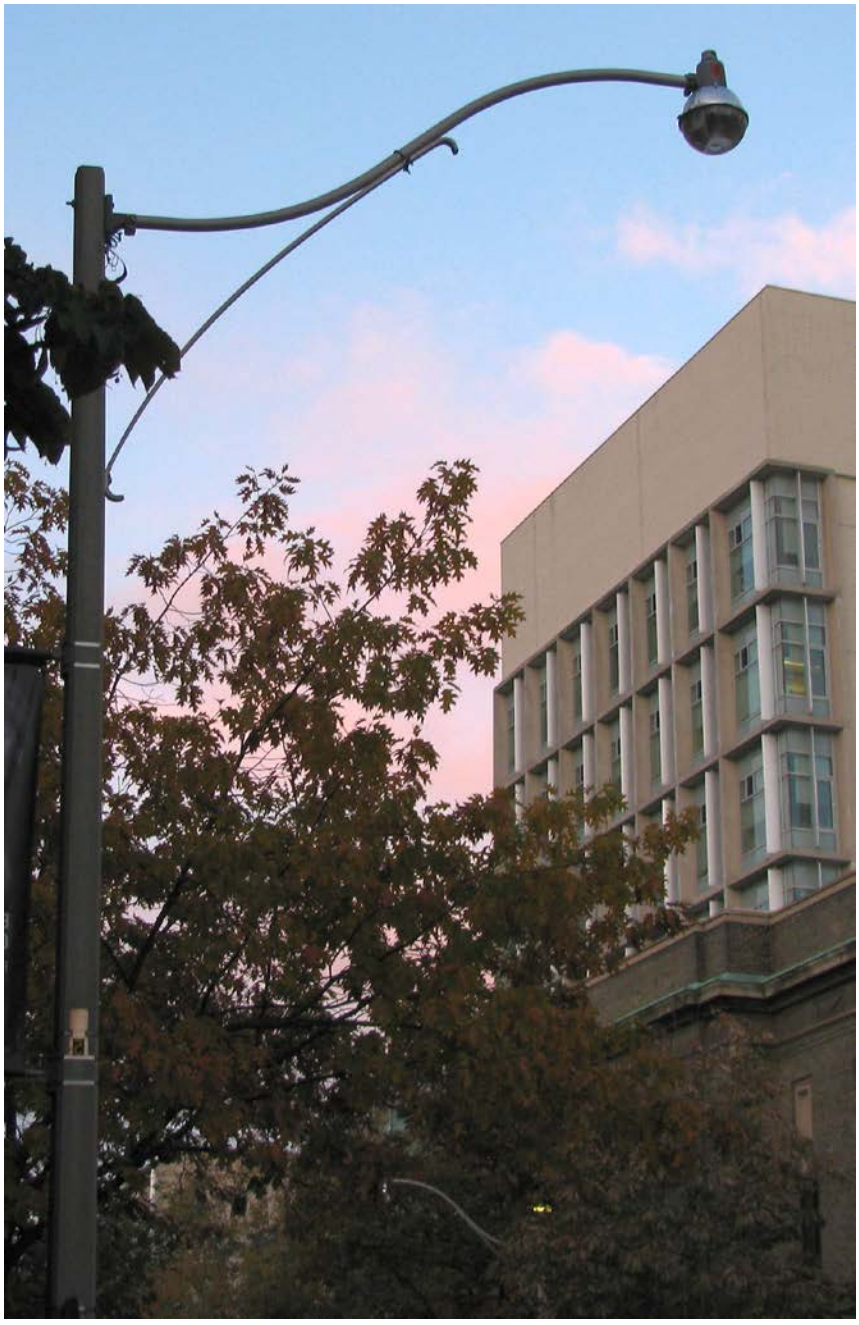

Figure 6: Original street light

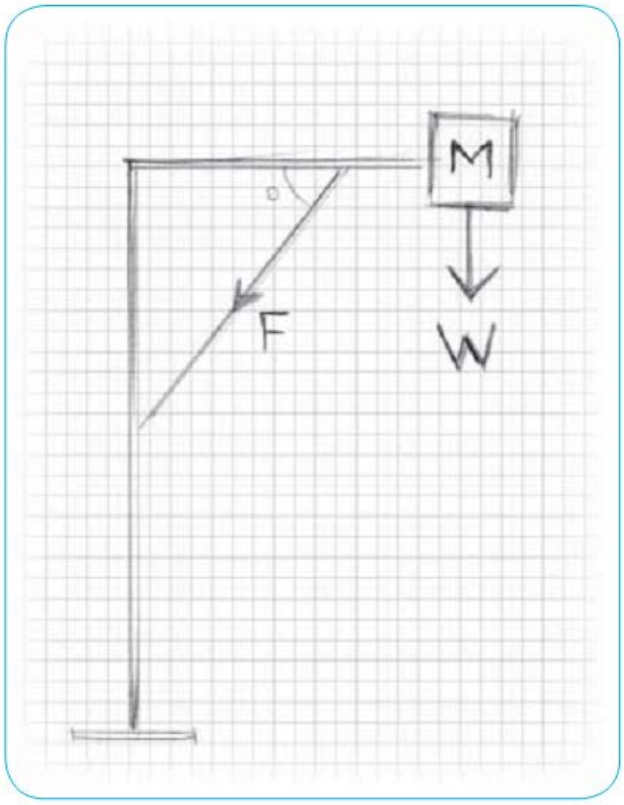

FIGURE 2 **A basic free-body diagram sketch used to solve the problem of estimating the safe maximum weight for the new light fixture.**

Excerpt from Textbook:

Thinking like an engineer means thinking verbally, visually, and mathematically. Engineers take a problem from the real world or text form, such as a client statement, and transform it so that they can solve the problem with science and mathematics. To achieve that transformation, they use models whether it is simply to show inputs and outputs or more complicated phenomena. Models are often represented in diagrams, which are essential to engineering thinking and communicating. They are used in design and problem solving and they are used in documenting the design or recommendation that is being made to a client. The results from problem solving are often depicted visually as graphs or charts before the solution is implemented back into the real world.

For many engineers, using diagrams is natural and intuitive. They draw quick, some- times messy sketches, put boxes around important ideas, and draw arrows to show connections. Such sketches may seem ordinary, but they are essential to thinking, communicating, and documenting the problem solving process. Engineering reports may include both formal polished drawings and also sketches. Ultimately, engineering drawings are used to help others execute (i.e., make or build) the technology you have designed. Creating diagrams and sketching out problems may not be a natural habit for you now, but it is an important skill. Diagramming a problem may show you the way to transform your perception of the problem leading to an ingenious engineering solution.

- 1 mark caption or title
- 1 mark pole represented/assumption around fixture stated
- 1 mark light fixture represented
- 1 mark forces represented
- 1 mark mass and/or weight of the fixture represented

Note: Students were confused whether Fixture referred to just the bulb area or the whole arm. They were told to state their assumption.

(5 MARKS) Estimate how many hotdogs are sold at a Blue Jay's world series game in the Rogers Centre Stadium. You don't have to get the same answer as us, but you do have to state all assumptions, demonstrate structured thinking, compute a number, and use appropriate significant figures.

1 mark: Estimate number of seats in the stadium

- Seats in the Rogers centre ~50,000
    - Generated using a comparison to a known quantity. Examples could include but are not limited to:
        - 10 x Con Hall
        - To another similar stadium to which the student has personal knowledge
        - Rough diagram with smaller estimates added up (ie. 10 seats per row, 10 rows per section 26 sections, etc)
        - If they just put down a number with not explanation where it came from they get just 0.5 mark

1 Mark: Determine what % of the stadium is filled. World series game would be sold out. They can assume a full house. They need to state this.

1 mark: They need to state the percentage of people who buy a hot dog. Less than 100% more then 0 %. Really any number will do as long as they state it and don't just ignore this step. I assumed 1 in 5.

1 mark: Must compute a number

1 mark: One significant figure

My answer:

50,000 / 5 = 10,000

Driving Event #1: Project Manager Training & Development Program

When the Project Management (PM) Training & Development Coordinator (T&DC) began work, there was no existing PMT&DC infrastructure at the Center to draw support from. Additionally, the predominately scientific and engineering community had little interest in PM and did not view it as a professional discipline. The PMT&DC took advantage of the lack of existing structure to be creative in fostering interest in and developing ways to deliver PM training which worked within the Center's culture. This approach, based on a community service philosophy, has resulted in a thriving PMT&D program and has made a significant positive impact on the Center's culture. The strategies used to accomplish this include making and leveraging personal contacts, developing mutually beneficial relationships with other entities interested in training, and being actively involved in training scheduling, enrollment and evaluation.

(From NASA https://llis.nasa.gov/lesson/1418)

39. (4 MARKS) Through analyzing Driving Event #1:

Three parts to a Lessons Learned and Strategy: Description, Analysis, Strategy

a. 2 Marks: What is one Lessons Learned you can derive?

- Needs to be a lesson learned not a strategy or a description. What was learned, NOT what happened or what they should do..
- 1 mark: Lesson should be specific to this case. If it is generic but a lesson then give 1 mark. IE. Being creative can solve problems.

Example answer: Creative approaches can be used to overcome cultural barriers to and resource limitations on a PMT&D program. (notice not just description, but not given concrete strategies either)

Incorrect lessons

- It may be impossible to teach new information to engineers if they have no prior interest in the value of it. (not true as evident in the case study)
- A community service philosophy can be leveraged through networking tools such as Slack or What's App. (They are just repeating words from the case study AND giving strategies)
- The engineering community had little interest in PM and did not view it as a professional discipline. (This is description not Lesson learned. There is no analysis.

b. 2 marks What is one Strategy for the Future that you can derive?

- Needs to be a strategy, not a description or a lesson. What NASA can do, not what happened or what was learned.
- 1 mark: Strategy should be specific to this case. If it is generic or can't be implemented by NASA, then give them one mark. "Engineers should be trained in Project Management from the start of their university education."

Example answer: In order to augment the resources of other training organizations, so that the Center's burden is reduced, efforts should be made to build mutually beneficial relationships. (notice this involves a future action)

Incorrect strategies:

- If there is no interest in a training program, your Project Management Team should recommend cancelling the initiative and finding another method. (not supported by case study results)
- Since understanding Gantt Charts is central to Project Management, the training team should begin by finding the appropriate app or program to intuitively build Gantt Charts. (A strategy, but not supported by the case study)