ENGI 1103 – Engineering Design 1

Project Projectile Motion

Projectile Motion

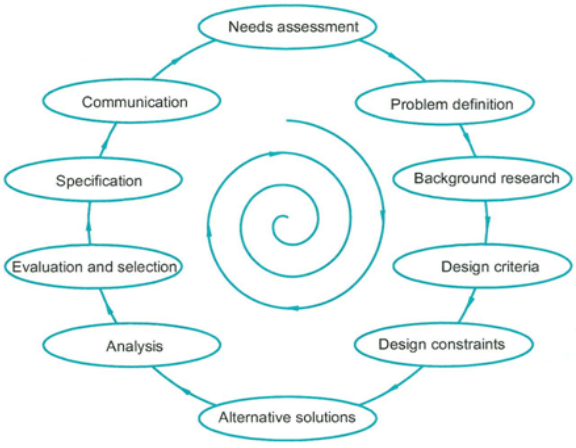


Figure 1-2 Engineering design process

Figure 1-2 from: Engineering Design Graphics, 2nd Edition, James M. Leake
Humpback Whale image from PowerPoint!

Ver.	Date	Description of change/updates
V1	Sep 29	Initial release.
V2	Sep 30	Updated track dimensions – reduced length from 6 m to 5m; set width to max hall width 2m
V3	Oct 22	Updated scoring Track (V3); added criteria 11 and 12; updated material list to V2

Problem Definition:

This year's design project will be to design and build a device utilizing projectile motion to deliver a hacky sac to the center of a scoring/target grid on the floor of the hallway in the Emera IDEA Building.

Using the supplied material kit (Motor, Wood, bearings, elastics, etc – refer to material list) each team will design and build a device to deliver a hacky sac to the target area from a fixed starting point (refer to scoring sheet/drawing).

Initial Criteria:

1. You can only use material as specified in the material list.
2. The delivery area will be the floor of the hallway (third floor) in the new Emera IDEA Building and will be a set location from a reference starting line.
3. The mass of the device (all components used) should be minimized.
4. The entire device must be behind the starting line prior to the start.
5. No part of the device can be left at the start line area.
6. No external interaction is allowed with the device after the initial start.
7. The entire device must stay within the track limits and come to a stop within the indicated stop zone.
8. Only the projectile (hacky sac) is permitted to leave the "Stop Zone".
9. All energy sources must come from the supplied material kit/list.
10. The device must fit into the provided storage box.
11. The hacky sac must be carried to the stop zone by the device.
12. The hacky sac can be launched from within the stop zone prior to the device coming to a stop.

Constraints:

1. The delivery runway (track size) is approximately 2m x 5m, followed by a stop zone 2m x 2m and then a scoring target 2m further down the track and measuring 2m x 2m (**refer to supplied target track and scoring grid)**.
2.
3.

Note: Problem definition, criteria and constraints subject to change. Refer to Brightspace for any modifications.

Evaluation:

Design Project	Value	
Design Shop Safety Quiz	1	Individual
Competition score*	10	Team
Presentation	6	Individual + Team
Participation & Attendance	3	Individual
Report/overall design	5	Team
Report (Appendices)	10	Individual
	35	

Report:

Each team is to submit a single report **(due Tuesday, Dec 3, at noon)** to R. Warner – at the Dunn - Room to be determined. The report must be printed on 8 - ½" x 11" paper and stapled.

You Technical Communication course will guide you on the content and format of the report.

The report must contain the following components

Front Matter

- Cover page.
- Title page.
- Table of contents.
    - Numbered sections and subsections.
    - Roman numerals for page numbers in front matter.
    - Arabic numerals for page numbers in body.
- List of figures.
- List of tables.

Body

- Introduction
- Project Background
    - Summary of problem definition, criteria, and constraints.
- Design Concepts
    - Review of initial design concepts.
- Final Design
    - Review of final design and scoring results.
- Conclusion
    - Assessment of the success of solution.
- Recommendations

Appendices

- Appendix A - Assembly Drawings
- Appendix B - Part drawings

The report should describe the design process that you used for your project, the competition results, and details of the final design. You can include pictures, scans/pictures of sketches and SolidWorks screen capture images as part of the body of the report.

The report will include Appendices that detail the final design. Appendix A will be SolidWorks assembly drawings and Appendix B will be detailed dimensioned drawings of each component in your final design. Additional details of the Appendix requirements are provided in their own section of this document.

Presentation:

Each team will also make a PowerPoint based presentation during the week of November 25th, during their regular scheduled lab period. Technical Communication will provide guidance on content and format.

- Introduction
- Project Background
    - Summary of problem definition, criteria, and constraints.
- Design Concepts
    - Review of initial design concepts.
- Final Design
    - Review of final design and scoring results.
- Conclusion
    - Assessment of the success of solution.
- Recommendations
- Questions

Presentations will be limited to 10 minutes for each team. This allows for typically 2 minutes per student plus 2 minutes for any questions from the class/instructors/TA's. Each student is required to present. There will be one team PowerPoint file that will be submitted to a designated ENGI 1103 Brightspace dropbox folder. This file must be in the folder before the start of your regular scheduled lab that week.

You will not have access to SolidWorks for the presentation, but you are expected to show your design details via SolidWorks images imbedded into your PowerPoint file. You typically would not show detailed part drawings as part of the presentation. You can supplement the SolidWorks design images with photographs of your design. You can also use images (scans) of hand sketches that outline some of your initial design ideas.

Report Appendices:

Appendix A: SolidWorks Assembly and Sub Assembly Drawings

The final design assembly drawings should be included in this appendix. The format should be similar to the **CAD assembly assignment (CAD #2)**. You should also include subassembly drawings if subassemblies were used. **Multiple sheets will be required for this appendix.**

1) **Include general assembly drawings that show the design assembled (orthographic views, isometric views).**
2) **Include an additional sheet(s) for overall exploded view(s) with BOM table.**
3) **Include exploded views of subassemblies if used.**
4) **Overall size dimensions should be shown in this appendix. You should also include part location dimensions as required.**
5) **Use ~~assembly section views and~~ detail views on the assemblies or subassemblies to better show areas of interest.**

Appendix B: Detailed SolidWorks Part Drawings:

A detailed dimensioned part drawing of each component of your device must be included in this appendix. The drawing format will be similar format to your CAD assignments (CAD #1) and must include dimensions as required to fully dimension the part. **The drawings should include section views and detail views if appropriate**. These drawing sheets are to be created using SolidWorks. A part drawing may require multiple sheets to properly dimension the part – but be sure not to use more views than required to fully dimension the part. You will be marked down if you use too many views. For simple part drawings it is recommended to use two orthographic views and one isometric view to fully define the part. Add additional views as required to not dimension hidden features.

Part Downloads and/or Purchased components:

You do not need to model purchased components in detail and you do not need to produce a detailed drawing for these components (they do not need to be included in Appendix B). Purchased items (ex: mouse trap, bearings, hinges, nuts, bolts, etc) can be modeled in basic form to be included in the assembly. The CAD data for these purchased items can also sometimes be downloaded from suppliers. Often these items can be downloaded from the internet in the file translation format "STEP". You can then use SW to open these files if you change the file open type to STEP. You can then save the file as a standard SW part file.

GrabCAD (http://grabcad.com) is a good site for these types of parts.
SDPI (http://www.sdp-si.com) is a good site for gears.
McMasterCarr (http://www.mcmaster.com) for fasteners and miscellaneous parts.

Note on Appendices Marking:

Each drawing in the appendices must contain the name of the person that created the drawing. The content of the appendices are to be equally divided among each team member and each will receive individual marks for their own drawings. You might decide to have one person to be responsible for assembly drawings, another for sub assembly drawings, the others for the detailed part drawings etc. You will have to decide how to fairly divide the work up based on your final design.

The Appendices are not team marks. **You will receive a zero for your appendix mark if you simply put drawn by "Team X" instead of the individual member that did the drawing.**

You are not to divide the work up such that one person writes the report and another does the solid works drawings etc.

As an example, if one person is assigned to do the assembly drawings – then they do not need to submit any part drawings and their mark will not be affected if another member does not submit part drawings.

Note on Appendices format and final report submission:

The appendices must be printed to scale (not to fit) on 8 – ½" x 11" paper as done in the cad assignments 1-3.

> **<u>Do not take screen captures of these drawings and paste them into your report appendices. They will not be to scale and it is not the way it is done!</u>**

A formal design report like this is typically done by saving the written report and the design drawings as pdf files. Adobe Editor is then used to merge the two pdf documents together to create one single pdf file of the report. Ideally this would be the way you would create your final report. However, Adobe Editor is not part of the general Adobe Reader application software that is include in most computer installations and indeed the University also does not have Adobe Editor as part of their software installation.

Since you likely do not have access to a way to combine these two sets of pdf files, you will submit the report in the following manner:

- **For CPST 1103:**

  For your digital submission of the report to CPST, you do not need to include the design drawings as part of the submission. You should be sure to include title pages for Appendix A and Appendix B, but you do not need to populate the appendices with the drawings.

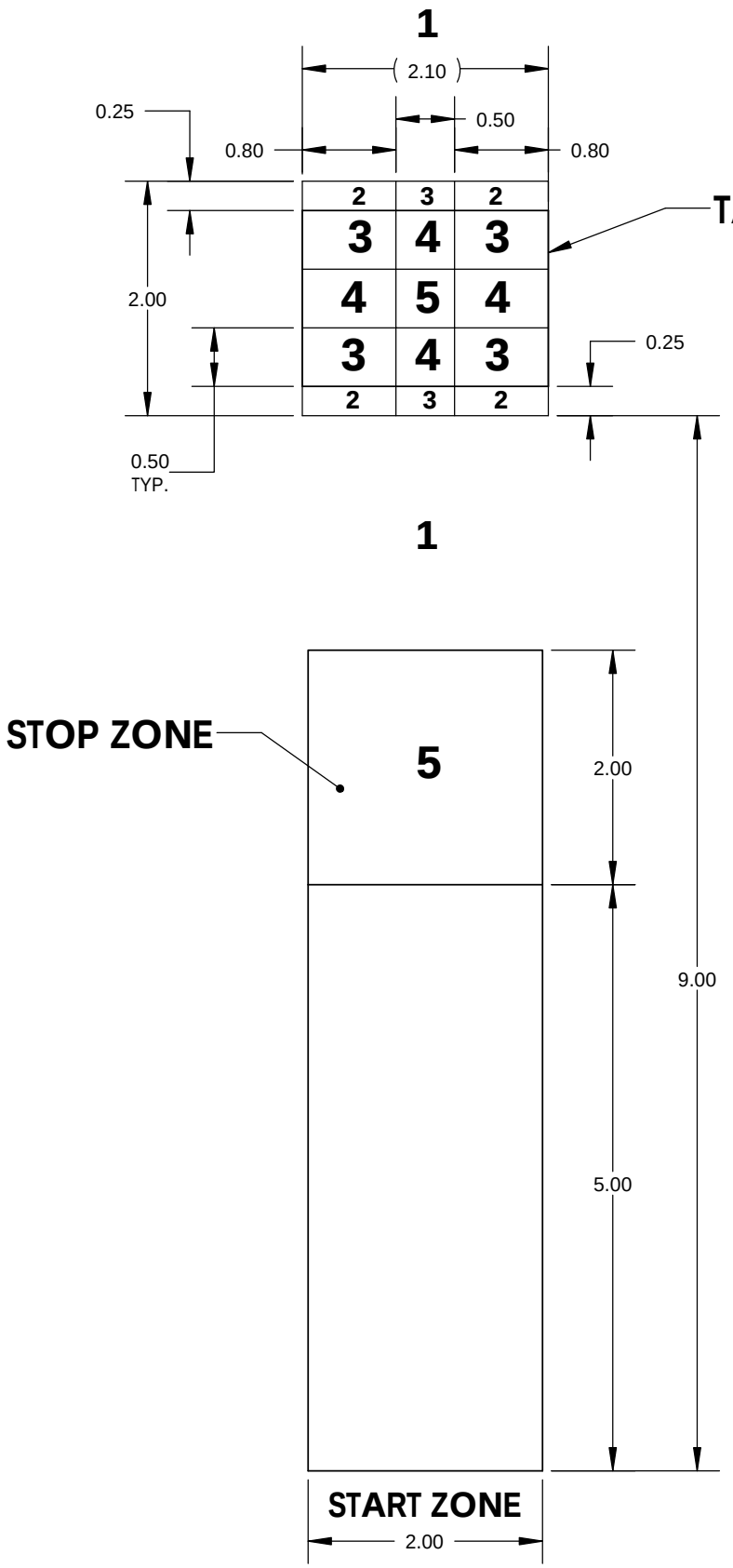
  If you happened to have access to Adobe Editor, then combine the word pdf doc with the drawings pdf's (ie populate Appendix A and Appendix B with their respective pdf drawings) and submit the complete report – appendices and all.

- **For ENGI 1103**:

  Print the report – complete with Appendices A and B title pages.

  Print the Assembly drawings and Part drawings.

  Organize the drawings and report together and staple the combined set for submission to R. Warner @ the Dunn - room to be determined- by noon on Tuesday Dec 3.



TOTAL POINTS AVAILABLE:

- 5 POINTS FOR STOPPING IN THE INDICATED STOP ZONE.
- UP TO 5 ADDITIONAL POINTS BASED ON FINAL RESTING POSITION OF THE HACKY SAC.

			REV: V3		
			DWN BY: RW		
Dalhousie University			PROJECT: ENGI 1103 - DESIGN PROJECT F2019		
	UNLESS OTHERWISE NOTED:		DRAWING: TARGET TRACK		QTY: N/A
	UNITS: mm X.XX +/- .10 X.X +/- .20 X +/- .50	UNITS: in X.XXX +/- .005 X.XX +/- .01 X.X +/- .02	ANGLES +/- 0.25°	MATERIAL: N/A	SCALE: 1:60
B00#:			DATE: Oct 22/2019	UNITS: m	SHEET 1 OF 1

Material List: ENGI 1103
Fall 2019

Release comment	Version	Date
Initial Release	V1	Sep 29/2019
Added Pan head M3 X 30 screws for motor mount; changed count of tongue depressors from 4 to 8.	V2	Oct 22/2019

Item	Part Number	Supplier	Size *	Qty per team
Hardware:				
Ball Bearing (bore x od x width) mm	100BC608ZZ	Amazon.ca	8 x 22 x 7	6
Hinge	1598A12	McMaster Carr	1" x 1"	2
90 degree bracket			3/4" x 3/4" nominal	6
Wood:				
Dowel			5/16" dia. x 24"	2
Dowel			1/2" dia. x 24"	1
Dowel			1/8" dia. x 6"	~~4~~
1/2" plywood			10" x 15"	1
1/4" plywood			20" x 15"	1
Poplar - wood			3/4" x 4 - 3/4" x 24"	2
Tongue depressors			5.9" x .66" x .062"	8
Electrical:	**Part Number**	**Supplier**	**Size**	
DC Gearbox Motor , 3-6V	1528-2589-ND	Digikey Canada	Refer to PDF/step file on digikey	1
Battery Alkaline 1.5V AA	P646-ND	Digikey Canada		4
Battery Holder AA - 4 Cell, 6V	SBH341AS-ND	Digikey Canada	Refer to PDF on digikey	1
Battery Holder AA - 2 Cell, 3V	1568-1408-ND	Digikey Canada	Refer to PDF on digikey	1
Jumper Wire M/F 6"	1568-1511-ND	Digikey Canada	6"	2
Thin White Wheel for TT DC Gearbox (2.6" OD)	1528-2587-ND	Digikey Canada	2.6" OD - refer to PDF on digikey	1
Connector Socket 22-26AWG Crimp TIN	A100846CT-ND	Digikey Canada		2
Connector Housing (1 position, 0.1 inch)	A26962-ND	Digikey Canada		1
Other:				
Victor Mousetrap				1
Hacky sac				1
Unlimited:				
Fishing line (XX lb monofilament)				
Wood screws - various sizes				
Pan head M3 x 30 Machine screws; nuts washers				
8-32 nuts				
8-32 bolts x various lengths				
Staples size #33 elastics			3-1/2" x 1/8" x 1/32"	
Staples size #64 elastics			3-1/2" x 1/4" x 1/32"	
Staples size #24 elastics			6" x 1/16" x 1/32"	
scotch tape (only for bearing fit adjustment)				
Wood glue				

List subject to change! - Refer to Brigthspace for current version.