ENGINEER 1C03 - Engineering Design & Graphics
McMaster Engineering 1
Cornerstone Design Project

Instructor: Dr. Nease
Last Updated: February 25, 2020

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1. Essential Details

1.1 Team Formation:

This is a **team project**. Teams must have **four** members, unless a lab section enrolment is not evenly divisible by 4, in which case three-member teams will be assigned at the discretion of the IAI. Team member names must be submitted to your lab IAI. Each team must obtain a team number for grading identification and online resources (ask your IAI for this if you do not have it!). If necessary, IAIs may reassign students to make appropriate sized teams. Decisions of which students to reassign are based on when a team/student registered with the IAI for the project. All members of each team must also enroll in their project "Group" on Avenue.

1.2 Submission Requirements:

This project will have a final submission of four components:

1) A technical design report
2) Complete set of working drawings
3) Software models, including solid/assembly modelling and dynamic simulation
4) Functional and fully assembled 3D printed prototype

1.3 Milestones and Submission Dates

There are several submission dates for this project outlined in the table below. They are:

1) Timeline and Agreement (Milestone 0)
2) Preliminary Design (Milestone 1)
3) Documentation of 3D printed Gears (Milestone 2)
4) Final Submission with Interview
5) Peer Evaluation

Description	Deadline
Milestone 0 – Timeline and Agreement	Friday February 14th, 2020
Milestone 1 – Preliminary Design	Friday March 6th, 2020
Milestone 2 – 3D Printed Gears	Friday March 13th, 2020
Final Submission with Interview	Mar 30th – Apr 7th (during Lab)
Peer Evaluation	Wednesday April 8th, 2020

2. Your Project: Design of a Hand Prosthesis

2.1 Overview

You have recently been hired by biomedical company 'BME Devices' and in a small team of engineers your first assignment is to develop a low-cost gripping apparatus as a proof-of-concept for an advanced prosthetic. A proof-of-concept design is common practice in industry for demonstrating the potential of an idea for real-world application before committing significant time and expense to developing a final design. The gripping apparatus is intended to act as a full-right-hand prosthesis, with the opening-and-closing of the fingers and thumb being driven by a gearing mechanism that connects to a single motor. The proof-of-concept device your team will be designing is the forefinger-thumb portion of the full-right-hand prosthesis.

For your custom design, there are important dimensional and operational requirements to consider and constraints to be met (these are outlined below). You will need to produce a solid model assembly of your design. Functionality of your design must also be demonstrated through dynamic simulation and rapid prototyping. Your team must also submit a technical report with simulation results and a complete set of engineering drawings that are in accordance with ANSI Standards. Your completed project (including technical report, prototype and all project files) is to be submitted following an individual and team oral assessment that will be scheduled in lab near the end of term.

2.2 Your Product

The proof-of-concept device your team will be designing is the forefinger-thumb portion of the full-right-hand prosthesis. The forefinger (i.e., index finger) and thumb are **driven by a motor** that has specific drive characteristics and is located near the wrist portion of the prosthetic. The **motor connects to the forefinger and thumb through a gearing mechanism**. The gearing mechanism is to be designed in such a way that the forefinger and thumb rotate: 1) in opposite directions with respect to one another (so as to simulate an opening/closing motion) and, 2) at a *specified* rotational speed that is slower than that of the motor. The **forefinger and thumb are to each rotate about a fixed axis at a specified location**. Finally, the **tips of the forefinger and thumb must contact each other within a specified volume of space**.

The **requirements** of this project are to:

1) Design a gearing mechanism that will incorporate the given input motor characteristics of the motor to produce the given rotational speeds of the forefinger and thumb.
2) Design the forefinger and thumb such that they contact each other within a given volume of space.
3) Design a custom mounting bracket that houses your gearing mechanism, supports the forefinger and thumb, and fits within the spatial constraints of the given right-hand prosthesis assembly.

2.3 Background Information: Anatomy of the Hand

A prosthesis is an artificial device that replaces a missing body part. The prosthesis in question is intended to replace a missing hand. While detailed knowledge of the hand, including anatomy and function, is not necessary for this course, knowledge of a few key anatomical terms and locations is necessary to better understand the intended function of the prosthesis and the design requirements your team must meet.

The hand is used for grasping and holding objects, exploring the environment (e.g., touching a surface), and communication and expression of motion. These activities are made possible by the high degree of mobility in the hand. This mobility is facilitated by the large number of joints (i.e., connection between two or more bones) present in the hand. Ideally, a prosthetic hand would replicate all the joints in the hand to provide the same degree of mobility and dexterity. However, accurate replication of the hand is not only extremely complicated, but also extremely expensive. As an alternative, hand prosthetics are typically designed to closely reproduce hand motion by replicating only the most prominent joints (e.g., fingers and thumb). An example hand prosthetic is shown in Figure 1 (the Raptor Hand by e-Nable).

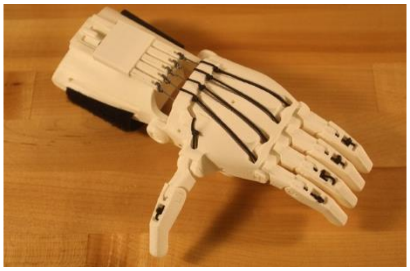

Figure 1: The Raptor Reloaded Hand Prosthetic (e-Nable)

Figure 2 show views of the side and the back of the hand. There are three landmarks that are especially relevant to your project. **Landmark 1** serves as the location of the motor's axis of rotation, and is located near the wrist. **Landmark 2** is the approximate site of forefinger rotation, and is approximately aligned with the joint between the forefinger and hand. **Landmark 3** is the approximate site of thumb rotation, and is approximately aligned with the joint between the thumb and hand. These last two joints are known as metacarpophalangeal joints (since they are the joints between the metacarpal bones, or hand bones, and proximal phalanges, or finger/thumb bones closest to the body). These joints are especially pronounced when the hand is clenched and a fist is made, and are commonly referred to as "knuckles".

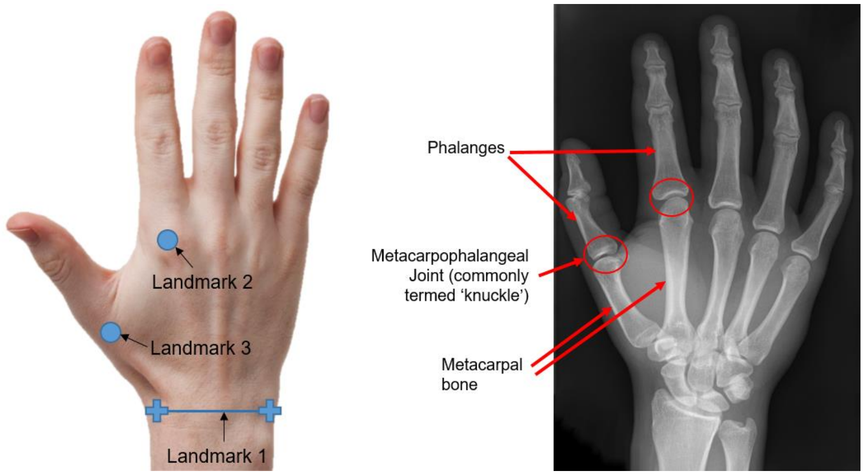

Figure 2: The Human Hand. (Left) the three landmarks relevant to your design project are identified. (Right) an x-ray of the hand with the key anatomy identified

The fingers in your hand each have 3 joints (including the knuckle) while your thumb has 2 joints (including the knuckle). These joints provide a great degree of mobility in your hand, allowing one or more fingertips to contact the thumb-tip in a wide range of positions. As a point of reference, touch the tip of your index finger to the tip of your thumb. Keeping them in contact, move them around while keeping the rest of your hand still. The locations in space that you're are able to move your index finger and thumb with their tips pressed together is known as the functional workspace.

For your project, it will be assumed that: 1) the forefinger and thumb are each rigid and only have 1 joint (the knuckle), and 2) motion of the forefinger and thumb is limited to 2D. Taking these simplifications into account, the path of motion of the forefinger-tip and thumb-tip can be visualized as a circular arc with center-of-rotation located at the knuckle (Figure 3). The location where these paths intersect is the point-of-contact between the forefinger-tip and thumb-tip (equivalent to the functional workspace). To provide flexibility in your design, it will be required that this point of contact lie within a given 2D 'window', similar to the one given in Figure 4.

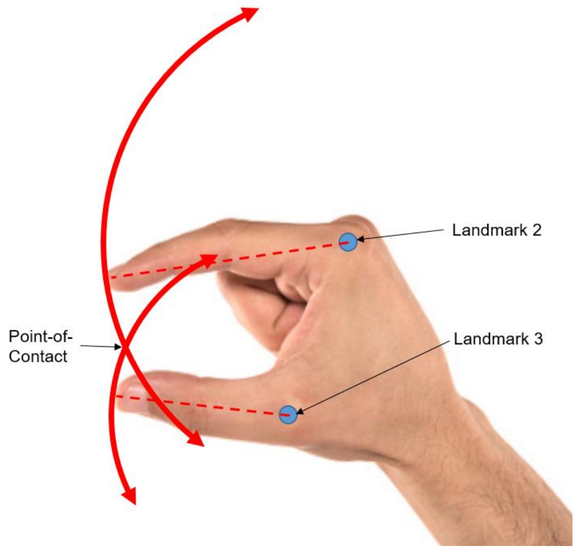

Figure 3: An approximation of the range of motion for both the forefinger-tip and thumb-tip. The intersection represents the point-of-contact

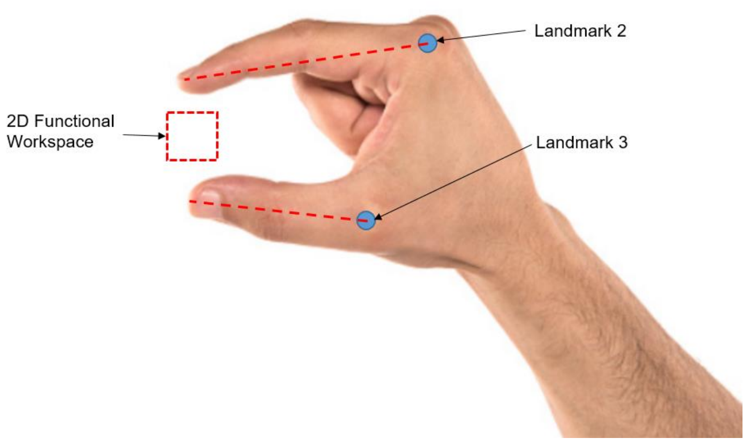

Figure 4: A graphical representation of the functional workspace. It will be required that the forefinger-tip and thumb-tip of your design contact each other someplace within this workspace. Note: this is a graphical representation only; detailed specifications are provided in Figure 6.

3. Details of Project Requirements

3.1 Gearing Mechanism Design (Requirement #1)

Movement of the forefinger and thumb is controlled by a motor, which has been positioned near the wrist. Based on your team number, **each team will be assigned a motor rotational speed (RPM)**. You are to **check the list provided on Avenue to Learn for your input speed once your team is assigned.** Speeds have been randomly assigned to all groups and do not contain any values that would lead to an advantage for some teams.

For all teams, **the forefinger and thumb are to rotate at a rate of 0.25 RPS**. To replicate an opening/closing motion, it is required that they rotate in opposite directions.

Your gearing mechanism must connect to the motor at the input (rotating at a speed that is a function of your Team number – see above), and to both the forefinger joint (Landmark 2, Figure 3) and the thumb joint (Landmark 3, Figure 3) at the output. The forefinger joint is aligned with the forefinger axis of rotation while the thumb joint is aligned with the thumb axis of rotation (Figure 5). The motor must be placed inside the prosthetic frame as follows:

- The back of the motor must be flush with the side wall of the prosthetic frame, opposite where the forefinger and thumb are located
- **The motor's base can be positioned up to 6mm from the back wall of the prosthetic frame** in order to accommodate various designs and gearing ratios

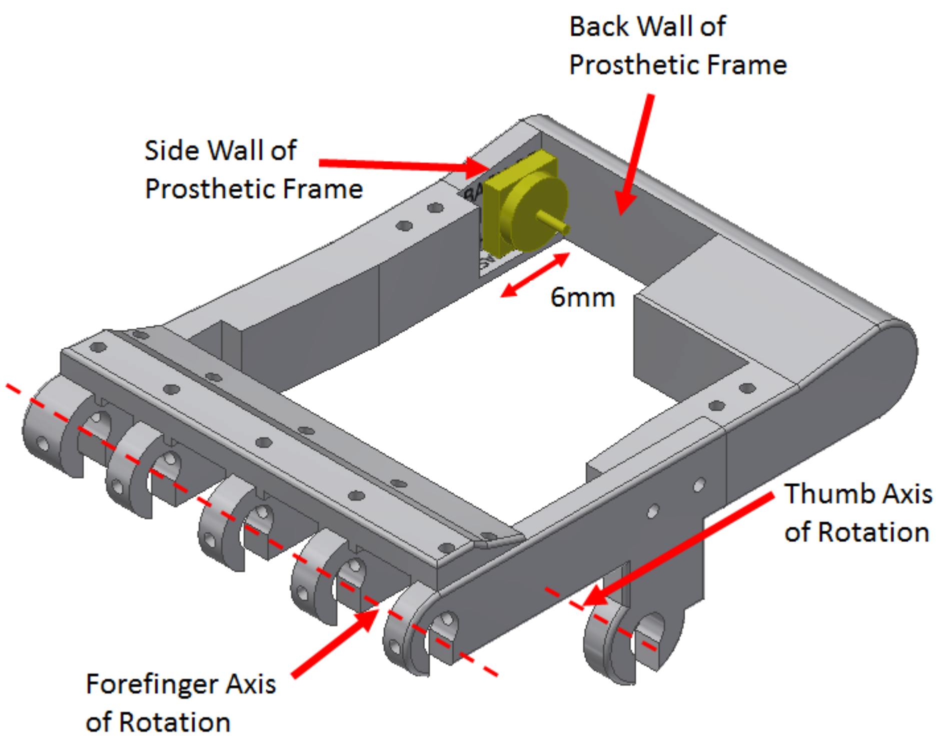

Figure 5: Partial assembly model of prosthetic frame with key landmarks indicated

3.2 Design of Forefinger and Thumb (Requirement #2)

Your design team is required to design the forefinger and thumb portion of the prosthetic. The forefinger and thumb are to be driven by the input motor and articulate about the respective axes of rotation (Figure 5). The forefinger-tip and thumb-tip must contact each other someplace within a 30-mm x 30-mm functional workspace. The location of this functional workspace is indicated in Figure 6 below. Beyond these requirements, the exact design of the forefinger and thumb (the length of each segment, the overall shape, etc.) is entirely up to you, and you are **strongly encouraged** to be creative!

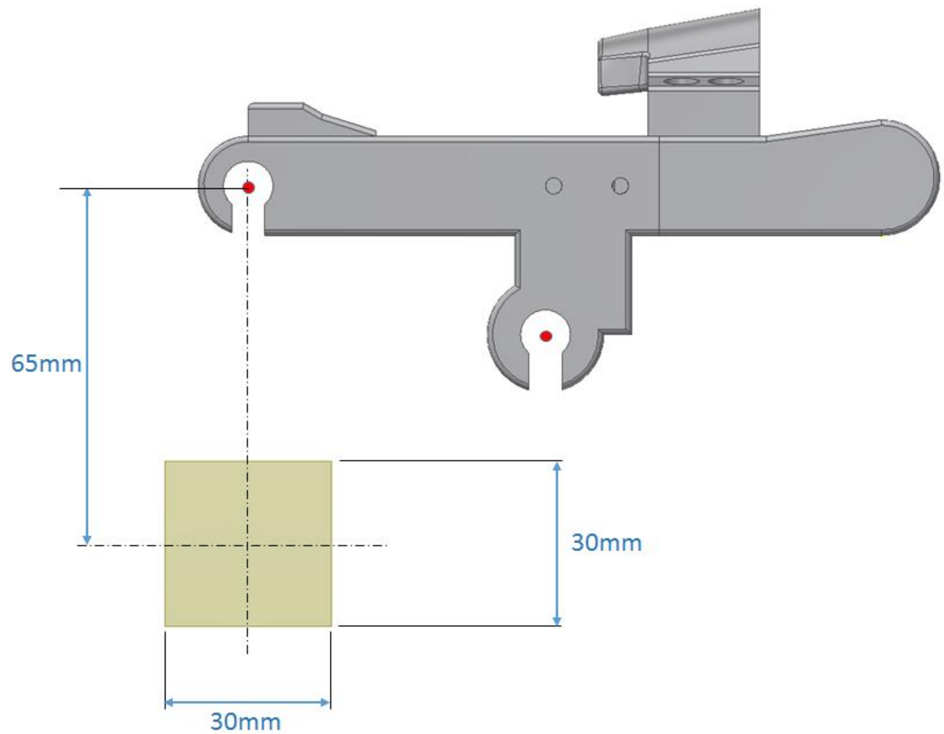

Figure 6: Location of the functional workspace 'window' relative to the forefinger axis of rotation.

3.3 Custom-Designed Mounting Bracket (Requirement #3)

Your gearing mechanism design must fit within the prosthetic frame (Figure 7) without modification to it, and **must include a custom-designed mounting bracket** for mounting all gearing components (e.g., shafts, collars, etc.) as well as the forefinger and thumb. When designing your mechanism to meet the dimensional constraints of the prosthetic frame, be sure to account for the dimensions of this mounting bracket.

Your mounting bracket is a **requirement** of the solid modeling and rapid prototyping portions of your project. Rapid prototyping will involve use of the 3D printers in the EPIC lab. For any fasteners (e.g., rods, screws, bolts, etc.), it is strongly recommended you purchase them rather than 3D print them. As with all printed components, **your team will be evaluated based on the appropriateness and utility of your design**. There are a limited number of 3D printers available at any given time to service upwards of 100 teams and overloading the printers with long and overly-complicated prints may result in unexpected printer failure. Therefore, the use of the 3D printers requires that your team design your parts using as little printing material as possible. **Designing components that result in excessively long print times may result in you being denied access to the EPIC lab until your components are re-designed**.

The prosthetic assembly (Figure 7) is not entirely enclosed, affording you some flexibility in your overall design. However, you should strongly consider the **appropriateness of your design** (including the final appearance of the prosthetic with the attached mounting bracket) when deciding the size of components and where to place them with respect to the prosthetic frame. At the same time, the **functionality of your design** will certainly be influenced by the number of gears you select. A design with too many gears may not function as well compared to a design with fewer gears. It is up to you to weigh the **appropriateness** of your design against its **functionality**.

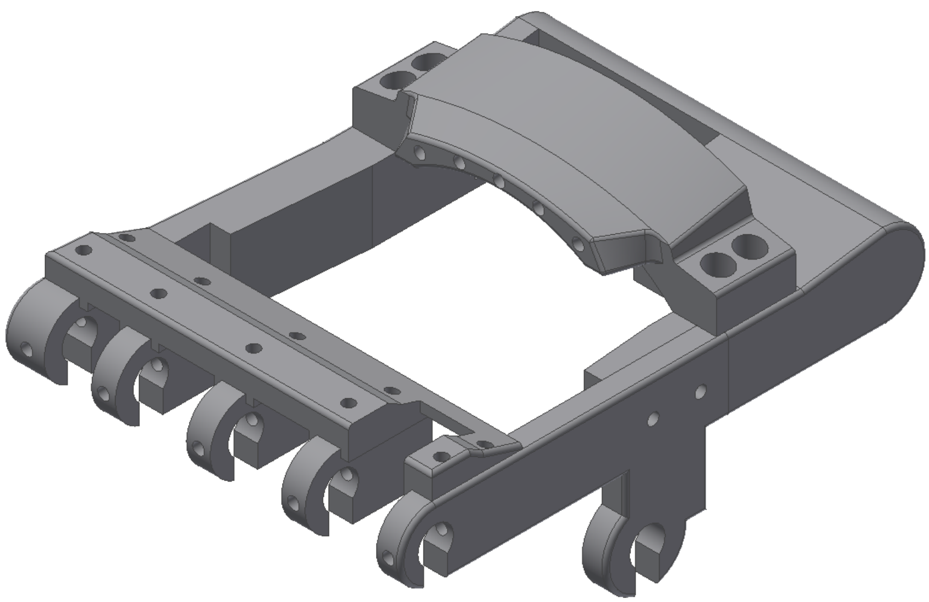

Figure 7: Isometric view of the prosthetic frame

4. Milestones and Submission Details

4.1 Milestone 0: Timeline and Agreement

Objectives and Requirements:

Functioning as a team requires some agreements on when a group will meet, how members will communicate, responsibilities, and a mechanism by which teams can communicate and resolve potential concerns before they impact the team/project. As such, the team must submit an agreement (including contact info) and a Gantt chart of project schedule (including agreed upon team meetings).\

Submission Checklist:

Your team will submit a report that includes:

1. Completed cover page (a sample is available on Avenue), including:
    a. Team number
    b. Each active member's name and student number
2. Signed academic integrity statement (please check Avenue).
3. An outline of team roles and responsibilities
4. Proposed project schedule showing team meetings, member deliverables, and project milestones in the form of a Gantt chart (1 page).

Grading of Milestone 0:

Milestone 0 is graded on a pass/fail basis. Failure to submit your milestone as outlined above will result in a 5% penalty to your final project grade. There is no rubric for this milestone.

Submission Deadline:

The file must be submitted electronically via Avenue to the Final Project Milestone 0 Dropbox **NO LATER THAN FRIDAY FEBRUARY 14th, 2020 at 6:00PM**.

4.2 Milestone 1: Preliminary Design

<u>Objectives and Requirements</u>:

Milestone 1 requires you to: 1) conceptualize your overall proposed design through preliminary hand sketches or CAD drawings, and 2) document the design of your proposed gearing mechanism through sketches, hand calculations, and defining gear design parameters.

1. <u>Preliminary Design Sketches</u>

Submit at least two (2) conceptual ***<u>hand-drawn</u>*** sketches of your proposed design. These are intended to be preliminary sketches for the purpose of **<u>concept generation</u>**. Your conceptual sketches do not require exact geometries; gearing components can be simplified to basic shapes (e.g., cylinders, discs, etc.). Your sketches should focus on general layout and configuration, and not specifically on gear ratios!

2. <u>Documentation of Proposed Gearing Mechanism</u>

Selecting **only ONE of your designs from above**, submit documentation of your proposed gearing mechanism including clearly labelled sketches, hand calculations, and a table of gear design parameters.

<u>Clearly Labelled Sketches</u>: submit a multiview sketch of your gearing mechanism ONLY, being sure to clearly label all gears (A, B, C, etc.). Details of the forefinger/thumb and mounting bracket should be omitted for clarity. Your multiview sketch should include the views shown in Figure 8.

<u>Hand Calculations</u>: submit correct and complete calculations of your gearing mechanism. Be sure that all calculations are clearly described. Use of an **equation editor** is recommended.

<u>Table of Gear Design Parameters</u>: submit a complete table outlining all design parameters for each gear. Each gear should be identified using the same convention from your multiview sketch. Refer to Table 1 for a list of required design parameters.

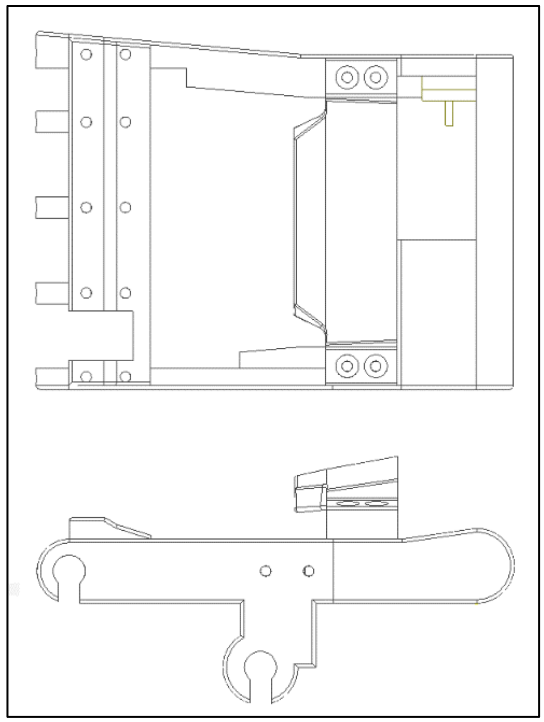

Figure 8: Views for gear sketches.

Table 1. An Example Gear Design Parameter Table

Gear Name	Type of Gear (e.g., spur, worm)	Connection to Preceding Gear		Pitch Diameter (mm), *D*	Module (mm/tooth), *m*	Number of Teeth, *z*
		Type (axial or mesh)	Name			
A	Spur	N/A	N/A	12	1	12
B	Spur	Mesh	A	24	1	24
C	Spur	Axial	B	15	1	15
D	Spur	Mesh	C	60	1	60

Practical Constraints:

The design of your gearing mechanism must adhere to the following constraints:

- The ratio between any two meshed gears cannot exceed 5 or be less than 1/5
- Minimum number of teeth on a spur gear is 12
- Watch your module. You are responsible to ensure your printed gears will properly mesh
    - Selecting TOO SMALL of a module may prevent this
- Gears should be reasonably arranged so that they do not extend too far from the prosthetic frame
    - When looking at the side view in Figure 8, the center of a gear should not extend above or below the frame (it's okay if part of a gear does)

Submission Checklist:

Your team will submit a report to an Avenue Dropbox. Your report must be saved in **PDF format** (NO exceptions. Use an equation editor!). **DO NOT** submit more than one (1) file. The content of your Milestone 1 report is as follows:

- Typed cover page, including:
    - Team Number
    - Lab Section
    - Each active member's name and student number
    - Signed academic integrity statement
- Preliminary Design Sketches
- Documentation of Proposed Gearing Mechanism, including:
    - Clearly labelled sketches
    - Hand calculations
    - Completed table of gear design parameters

Grading of Milestone 1:

Your **Milestone 1 Report is worth 5%** of your final project grade. All active Team members will receive the same grade. A Milestone 1 Rubric will be posted to Avenue.

Submission Deadline:

The report must be submitted electronically via Avenue to the Final Project Milestone 1 Dropbox **NO LATER THAN FRIDAY MARCH 6th, 2020 at 6:00PM. However, it is strongly advised for 3D printing reasons that you consider finalizing your design in advance of this due date.**

4.3 Milestone 2: Documentation of 3D Printed Gears

Objectives and Requirements:

The objective of Milestone 2 is to update your progress by documenting the status of your design. There are two principle components required for successful completion of Milestone 2:

1. Solid Modelling of All Gears

Model all gears of your mechanism using the Design Accelerator tool in Autodesk Inventor. Keep in mind that your mechanism is required to fit inside the prosthetic frame when mounted to a mounting bracket. It is **YOUR RESPONSIBILITY** that the size of your gear teeth (e.g., module for spur gears, ACP for worms) will result in gears that properly mesh. If gears do not mesh because selecting too small a module, this will affect your final grade

2. 3D Printing of All Gears

Print ALL gears using the 3D printers available in the EPIC Lab. You are not required to assemble your gearing mechanism; you only need to print the gears. Your gearing mechanism does not need to exactly match what you designed for Milestone 1. Submitting different gears is acceptable if you are still meeting the design requirements outlined above

Submission Checklist:

You are required to submit a photo as evidence that you have completed Milestone 2. The photo should adhere to the following:

- All gears should be clearly laid out on a flat surface with a high contrast background (e.g., white gears should be taken on a dark surface or vice versa)
  - All gears should be in a single photo
  - Gears should not overlap each other
  - Proper lighting should be used such that gear details (e.g., gear teeth) can be clearly made out
- The photo must be saved as a JPEG (**No other file format is acceptable**)
  - The photo must be saved with your Team Number as the file name (e.g., “Team 1.jpg”)

Grading of Milestone 2:

Milestone 2 is graded on a pass/fail basis. Failure to submit your milestone as outlined above will result in a 5% penalty to your final project grade. There is no rubric for this milestone.

Submission Deadline:

The file must be submitted electronically via Avenue to the Final Project Milestone 2 Dropbox **NO LATER THAN FRIDAY MARCH 13th, 2020 at 6:00PM**.

4.4 Final Submission with Interview

<u>Objectives and Requirements</u>:

You will be required to submit your design and present your results in a project interview forum. Every member is expected to participate in each aspect of the project. There are five components to this final submission.

1. <u>Technical Report:</u>

Combine your design and modelling work into the final technical report. Accurate and efficient modelling, overall design, and presentation are significant considerations. The format of your report should be neat, structured, and organized. Use a 12-point serif font (e.g., Times New Roman). For all references, you should adhere to the IEEE format (https://www.ieee.org/documents/ieeecitationref.pdf). At a minimum, your typed report should contain:

1. Typed cover page, including:
    a. Team Number
    b. Lab Section
    c. Each active member's name and student number
    d. Signed academic integrity statement
2. A Table of Contents
3. An Introduction (max 1-1.5 page(s)), focusing on:
    a. A summary of the design problem
    b. Description of your final design, and how the mechanism works
    c. An overview of the material covered in the technical report
4. A set of calculations for the gear train design
5. Table of mechanism design parameters
    a. Refer to requirements for Milestone 1; submit updated version if changes required
6. Simplified gearing mechanism diagram
    a. Refer to Figure 8 above; gears should be represented as discs/cylinders
7. Screenshots of your design, including both the **<u>AUTODESK INVENTOR MODEL</u>** and the **<u>PRINTED PROTOTYPE</u>**
    a. Orient each such that gears are clearly visible
8. Images of the output graphs for Inventor's Dynamic Simulation environment
9. Brief explanation of your ***<u>prototype</u>*** design, outlining any challenges you encountered as well as an explanation of any unique or creative features that separate your design from other groups
10. A summary table of what each team member contributed to the project
11. A summary of all team meetings and member attendance
12. Gantt chart outlining specific tasks/goals, meeting dates, and expected/actual task/goal completion dates

2. <u>Complete Set of Working Drawings:</u>

Submit a complete set of working drawings (ANSI drawing conventions), including both detail drawings and assembly drawings. Submit detail drawings (i.e., engineering drawings) of all components that were designed by your team and printed (standard components such as fasteners can be excluded). All detail drawings must be properly dimensioned. The assembly drawing should clearly illustrate how the product is arranged and include a bill of materials. All drawings must have a title, an author, and be numbered.

3. Software Models

Create Solid Models of all components (gears, forefinger/thumb, mounting bracket) in Autodesk Inventor. Create an Assembly of your mechanism, being sure to constrain it to the prosthetic frame (Hand Assembly.iam). Be sure to properly constrain all components (i.e., mechanical components should have remaining degrees of freedom, fixtures and structural components should not). Create a Dynamic Simulation of your mechanism to verify its functionality. Be sure to include output graphs of your simulation in the technical report.

4. Functional and Fully Assembled 3D Printed Prototype

Complete a 3D fabricated, assembled, and working model of your design. Note your design is **NOT** to include the actual prosthetic frame. All components (gears, forefinger/thumb, mounting bracket) should be printed in the EPIC Lab. An exception to this is standard components (rods, screws, bolts, etc.), which are best to be purchased from a hardware/craft store.

5. Project Interview

Your team / individual assessment will be during your assigned time in your week 12 labs. You will be asked questions related to your team design. There will be individual questions and team questions. Each team member must be able to answer questions about any aspect of the design (calculations, part models, assembly models, system models, etc.). All members must be present for the project interview. Teams/members missing will be assigned a 0 for the interview component of the project.

You will be required to bring the following with you to your scheduled interview:

- A summary report (hardcopy) consisting of the following:
  - Cover page with team number, signed by all members accepting the academic integrity policy
  - A table of specific items that each team member contributed to the project
  - An exploded assembly drawing of the gear train design
  - Print out of probe plots from Inventor's Dynamic Simulation Environment
- All Software Models for demonstration
- Your Functional and Fully Assembled 3D Printed Prototype for demonstration and validation

Submission Checklist:

You are required to submit the following deliverables:

- A digital copy of your Technical Report
  - Submit in **PDF format** only
- A digital copy of your Complete Set of Working Drawings
  - Submit in **PDF format** only. Inventor drawing files can be submitted with your other software files, but they will **not** be considered for grading
- Autodesk Inventor Software files required to review/reproduce your parts, assemblies and draft files, as well as verify your dynamic simulation.
  - Submit all files in a single **ZIP folder using Pack N Go**.
  - Ensure your files can be opened on any computer running Inventor
- A video of your Functional and Fully Assembled 3D Printed Prototype
  - A video will be recorded by the TA/IAI during your interview. You are not expected to bring a video with you

<u>Grading of Final Submission</u>:

Your final submission consists of a group component and individual component.

The **<u>Group Component</u> (75%)** is based on how well your team answers the project interview team questions, the technical report, the complete set of working drawings, the software models, and design/demonstration of your prototype.

The **<u>Individual Component</u> (20%)** is based entirely on how well each team member answers the project interview individual questions

A <u>Final Submission Rubric</u> will be posted to Avenue. Note that the remaining 5% of your project grade is based on your score for Milestone 1.

<u>Submission Deadline</u>:

All project deliverables are to be submitted electronically via Avenue to the <u>Final Project Files Dropbox</u> **NO LATER THAN 60 MINUTES AFTER YOUR SCHEDULED PROJECT INTERVIEW CONCLUDES**.

The video of your 3D printed prototype does not need to be submitted since the TA/IAI will record it on their device; however, exceptional prototypes may be collected for showcasing in the EPIC Lab

4.5 Peer Evaluation

Objectives and Requirements:

In addition to your TA/IAI's evaluation, each team member must complete a report evaluating themselves and the other members on their overall work; this will factor into each individual member's final mark. This portion of the evaluation is implemented as a deduction. Members who clearly do not participate equally will be deducted at the instructor's discretion. Any member not submitting a complete set of peer/self-reviews will receive a 5% penalty to their overall project grade.

Submission Deadline:

Peer evaluations must be submitted electronically via the provided peer evaluation link **NO LATER THAN WEDNESDAY APRIL 8th, 2020 at 11:59PM**.

5. Team Dynamics

Working as a team can present challenges beyond the technical details. Teams are strongly advised to consider a Gantt chart very seriously and (at minimum) to schedule a weekly team meeting (at a minimum once per week). Agree on a form of communication and ensure to document each member's contact information. You will be submitting a summary of meetings and attendance in the technical report.

Any team problems must be addressed to the course instructor (Jake Nease) as soon as possible but no later than **Monday February 24th, 2020**. The objective of this reporting system is to help resolve conflict and move forward as a team; only in **extreme** circumstances will alternative actions be taken.

6. Overall Evaluation and Academic Honesty

Working as a team is a good way to learn from one another, but it presents its own challenges. It is not the point of this assignment that a single person does all the work and the others observe; each member is expected to participate equally in all areas of this project and each member will be examined on the overall project. Although you are working as a team, academic integrity is still an issue. Drawings and/or reports copied in full, or in part, may result in all team members being charged with an academic integrity violation. Any student unable to explain the work for which they are assuming credit may be assigned a 0 for the entire project and will be reported to the office of Academic Integrity.

7. Bonus(!!1!one!!1!)

During your Project Interview, 3D printed prototypes of the prosthetic frame will be made available in the Lab. Groups with a Functional and Fully Assembled 3D Printed Prototype that can fit inside 3D printed prosthetic frame without any modifications to the frame or the design itself will be eligible to receive a **5% bonus to the Group Component of their project**. Please note the following:

- The 3D printed prosthetic frame will not be made available until the Project Interview
- Although the prosthetic is based on the Autodesk Inventor assembly posted to Avenue, keep in mind it is printed using the same 3D printers you are using, and thus susceptible to the same inaccuracies

8. Academic Integrity Statement for Reports

Each Cover Page submitted must include the following statement for each Team Member, complete with signatures (see Avenue for a sample page):

> As a future member of the engineering profession, the student is responsible for performing the required work in an honest manner, without plagiarism and cheating. Submitting this work with my name and student number is a statement and understanding that this work is my own and adheres to the Academic Integrity Policy of McMaster University and the Code of Conduct of the Professional Engineers of Ontario.
>
> Submitted by [Full name, student number]

9. Change Log

FEB 25: Changed the due date of Milestone 1 to be March 6^{th}, 2020.