Design Exercise #3. Design of Gear-Box

Assigned: 12/5/12, Due Date: final exam

Grading:

15 points (style, grammar, organization),
10 points (quality of drawings),
10 points (Design Content: Calculations),
5 points (Design Content: Functional Requirement-Design Feature Mapping),
5 points (Design Content: Cost Estimates)
55 points (Design Content: Design Quality, Completeness, Buildability)

The second level functional requirements for your design will be

A) a machine frame to contain all components and allow adjustment of the range
B) an element to store energy for release on firing and transfer that energy to the potato
C) a automatic mechanism, actuated by the two provided servo motors, which will hold the element in B in the fully loaded position and which will decouple the gearbox (D) from the energy storage element (B)
D) a gearbox, actuated by the supplied DC motor, which will wind the energy storage element (B) through the coupling (C).

This design exercise is to develop a design to fulfill functional requirement D.

Constraint One: The catapult in one configuration must fit into a box 24"x24"x12" in some orientation.

Constraint Two: You may only use steel gear stock from Stock Drive Products (www.sdp-si.com):

20 pitch, steel, 20 degree PA: 12, 14, 16, 18, 20, 24, 30, 35, 40, 45, 60
24 pitch, steel, 20 degree PA: 12, 14, 16, 18, 20, 24, 30, 36, 42, 48, 60
32 pitch, steel, 20 degree PA: 16, 18, 20, 22, 24, 32, 36, 38, 40, 48, 60

Identify the third level functional requirements for FR D (call them D1, D2, …).

Design Output: Produce a report that includes the mapping of Functional Requirements to Design Features.

Discuss special features or design decisions so as to facilitate the selection of your device for the group's build.

Provide engineering calculations which support your decision-making process. In particular,

What is the desired output to your gearbox (max. power torque, ½ no load speed, max. efficiency torque, no load speed)? Justify your decision. Provide a range on your output so that you can achieve a range of gear ratios.

Fill in the table from the homework with gear teeth, stall torque, no load speed, tooth stress, so that you can assess the likelihood of failure under load.

Provide detailed engineering drawings for all parts and assembly drawings to illustrate your design concept. Drawings should be sufficient for your group to actually build the device. This is not a rough draft.

Provide an inventory of parts that need to be purchased, along with part numbers and suppliers and cost (put it in a table please).

Provide an inventory of materials that need to be purchased, along with part numbers and suppliers and cost (put it in a table please).