ME 360L Project – Fall 2008 Bicycle Crank

You work for a manufacturing firm that makes accessories for bicycling. The marketing department in your company wants to create a new high end crank and double chainring set to for road racing that augments the ir line of other products. Marketing requests the following for the crank set.

- 1. The crank set will consist of both crank arms and two chainrings.
- 2. It must be very light weight so that it will appeal to competitive cyclists.



- 3. The crank arm length (center to center) will be 172.5 mm.
- 4 The two chainings will have 53 and 39 teeth.
- 5. Your product should be lighter than your chief competitors set. Their set has the following weights:

1.	Left crank	175 grams
2.	Right crank + chain rings	465 grams
3.	Total weight	640 grams

- 6. Your company has built its reputation on an aluminum alloy it calls Ultralite. This alloy is actually aluminum 6061T6. You will use this material in your design.
- 7. The crank arms must attach to standard pedals and to standard bottom bracket cassettes.

In this assignment, you will design and structurally analyze the crank arms, chain rings, and bolts used for retaining the chainrings. Assume the bottom bracket (axle connecting the crank arms) is sufficiently strong for the loads and does not have to be analyzed.

Define four different load cases you think will be sufficient to develop the maximum performance envelope for the crank arms and chain rings. The loads should relate to a 200 lb rider and should take into consideration both heavy riding and accidents.

Define the limits for stress and deflection you feel are appropriate for the material and load cases you are analyzing. These limits should be somewhat conservative so that reasonable loads you have not anticipated do not damage the crank set or fail to provide stability for the rider.

Analysis Plan

You will develop an analysis plan that will guide your structural analysis of the parts. The analysis plan should contain:

- 1. A discussion of how the loads were derived and how they fit into the overall analysis plan to develop a maximum performance envelope for the crank set.
- 2. Sketches of the chain wheels and crank arms with loads and constraints shown on the drawings. Different drawings will be used for each change in the loads and constraints.
- 3. The report will be typed. The sketches may be hand drawn.
- 4. The analysis plan will be due November 3, 2008.

Final Report

This project will culminate in a report. The report will contain:

- 1. Dimensioned drawings of the crank arms, chain rings and chain ring connection bolts.
- 2. A discussion and justification for the load cases you used in analyzing the crank set. Discuss any departure from the Analysis Plan and the justification for the departure.
- 3. A discussion and justification for the stress and deflection limits you used in the design.
- 4. The results of each load case detailing:
 - a. The loads and how they were applied. Illustrate with a fringe plot. The fringe plot should show the location and magnitude of the maximum stress and the maximum displacement. The plots should be large enough to easily see and understand the stresses and displacements. Multiple plots can be used for each load and constraint case.
 - b. The constrains and how they were applied. Illustrate with a drawing or diagram (this can be the same drawing or diagram as used for the loads).
 - c. A comparison of the load and deflection limits you set for the problem in the analysis plan with those computed in the analysis.
 - d. The design should be optimized so that a near minimum weight is achieved without exceeding the stress and deflection limits defined in the Analysis Plan.

e. The report is due at the end of class December 11, 2007

Oral Presentation

Each group will make an oral presentation detailing their analysis plan, the analysis results, and the shape and size of the final crank set. Power Point will be used for the presentation. The presentation will be made during the lab period on December 11, 2007.

Grading

Analysis Plan	100 points
Final Report	200 points
Oral Report	100 points