ME 340 LAB #3 - FATIGUE **January 21, 1999**
WINTER 1999

NAMES:_____

- ✓ Work in groups of 2-3 people.
- ✓ Put names in alphabetical order.
- ✓ Work in pencil.
- ✓ Points will be deducted for sloppy work.
- ✓ Work must be turned in at the end of the period.

The shaft shown in the figure below is made of cold rolled 1050 steel and carries three gears. The goal of this exercise is to size this shaft for an infinite life with a factor of safety of 1.5 in fatigue and a margin of safety of 0.25 in yield. The surface is machined, it operates at room temperature and a reliability of 99% is desired. Assume for the purposes of this calculation that the theoretical stress concentration factors are 2.8, 3.1, and 2.4 in bending, torsion, and axial loading respectively and the notch radius at the critical point is 3/32 in. Note also that F_A and F_C have equal magnitudes; F_A=0.470i-0.342j+0.814k and F_C=-0.470i-0.342j+0.814k. The bearing at O carries all thrust.

- Draw a free body diagram for the shaft.
- Calculate bearing reaction forces and the values of F_C and F_A
- Draw shear and bending moment diagrams for the shaft in both planes.
- Identify the critical point on the shaft, i.e. its location.
- Calculate all stresses and the Von Mises equivalent stress at the critical point.
- Draw and use a modified-Goodman diagram to calculate an appropriate diameter for the shaft in order to satisfy the design parameters listed above.