ME 360 – H04 Name _____

USE THIS SHEET AS THE FIRST PAGE OF YOUR HOMEWORK SUBMISSION

1) The motor from a DeWalt DW960 right-angle 18V cordless electric drill is used for direct drive of one track on an unmanned ground vehicle (UGV). The DW960 motor delivers 0.7 HP at 275 rpm and has a step-down output shaft from 0.78 inch DIA to 0.43 inch DIA with 0.025 inch fillet radius. The DW960 motor drives a 15T sprocket for the track with link-to-link pitch of 0.7 inches. The center line of the track is 1.8 inches from the step-down of the shaft. The shaft is 4340 steel (quenched and tempered at 800° F). The UGV weighs 70 pounds and has two tracks (one on each side). Each track is driven by one DW960 motor. Determine –

overhang

a) torque on the sprocket _____ in.lbf

b) tangential force on the sprocket _____ lbf

c) nominal bending stress on the shaft at the step-down _____ ksi

d) nominal torsional shear stress on the shaft at the step-down _____ ksi

e) actual bending stress at the step-down _____ ksi

K_t bend $\neq$ K_t tors

f) actual torsional shear stress at the step-down _____ ksi

g) von Mises effective stress at the step-down _____ ksi

h) factor of safety for yield failure of the shaft _____

i) UGV speed at 275 rpm sprocket rotation _____ mph

2) Briefly describe the differences between 1040 and 4340 steels that have been quenched and tempered at 800° F in terms of yield strength, ultimate strength, hardness, chemical composition and cost. **Create a table and provide typical numerical values**. Remember to cite your sources.