**ENGR 3117: Computer-Aided Design Course Outline**

**MEE 3117: Computer-Aided Mechanical Design Course Outline**

**Bolt Project Fall 2022**

A 30 mm thick AISI 1020 steel plate is sandwiched between two 10-mm thick 2024-T3 aluminum plates. The plates are compressed with a clamping force of 18 kN. The maximum dimension of the plates can not exceed a 6 in by 6 in square. An external tensile of 10 kN load is applied to the center of the top plate while the bottom face is fixed.

Determine a bolt arrangement that minimizes stress in the plates for both the loaded and unloaded conditions, has a C value (fraction of the external load carried by the bolt) of between 0.2 and 0.3 for each bolt, and a minimum factor of safety of 1.5 for the bolts. Note that the stress in your plates can also not exceed the yield stress of your materials.

You can vary the type, size, and number of bolts as well as the length and width of the plates (or shape if you want to get creative). However, you cannot use washers or change the thickness of the plates. Remember you have to design a realistic bolt! This means using standard diameters and threads per inch and proof strength.

If you cannot achieve one of the design constraints clearly explain why and if you think this is an acceptable trade of towards your overall design.

Verify your final solution with hand calculations based on machine theory. This includes the axial stress in the bolts and the FOS of the bolts, and the c value.

Your report must contain an explanation of all the choices that you made towards your design as well as the forces in each bolt, the stress in the plates for both the unloaded and tensile load, and a comparison of your FEA results and theoretical calculations. Additionally, while not a constraint the FOS for the plates should be investigated as well as a discussion of shear stress in the bolts.

This report at minimum should be 5 single spaces pages without figures. The professional quality of your report will be factored into your grade.