MECH LAB. I

MEASUREMENT EXPERIMENT

"Volume, Density and Area, Polar and Mass Moment of Inertia"

Form groups composed of three or four members for conducting this experiment.

PART I

1. Balance the Scales.

2. Using Vernier/Dial/Digital Caliper, Micrometer and Linear Scale, obtain all dimensions necessary for calculating the <u>*VOLUME*</u> of each of the provided specimen (refer to the Specimen Identification Sheet). Generate a precise SECTION drawing of each specimen using a <u>*Ratio of 4 to1*</u>.

3. Using the Scales, obtain the <u>*WEIGHT*</u> of each specimen. (Use a value of $g = 9.8066\ m/s^2$)

4. Using the information obtained in steps #2 and #3, determine the MASS and WEIGHT <u>*DENSITIES*</u> of the material for each specimen BOTH in SI and USCS units.

5. Tabulate the results in step #4 in a highly organized fashion (Create a Table).

6. For <u>*EACH*</u> of the specimens **"A" and "B"**, calculate $S_1 = I_{xx}/C_y$ and $S_2 = I_{yy}/C_x$ and obtain the ratio of S_1/S_2 . What important observation may be made by examination of this ratio? Explain in a BOXED paragraph.

7. For Specimen **"A"**(ONLY), and the shown *loading,* what is the <u>*RATIO*</u> of σ_1/σ_2 ?

$$\text{Recall that: } (\sigma = MC/I = M/S)$$

8. For specimens **"C" and "D"**, calculate the <u>LARGER</u> of the **S/W** Ratios for <u>each</u> of the specimen and then COMPARE the *TWO* Ratios with each other.

9. Repeat step # 8 for Specimens **"E" and "F"**.

10. For <u>*EACH*</u> of the specimens **"K", "L" and "M"**, calculate the <u>*Polar Moment of Inertia*</u> $(I_p = J)$ and <u>ALL</u> J_i/W_i Ratios and then COMPARE the *THREE* Ratios with each other. What significant observation may be made by evaluation and comparison of these Ratios? Explain in a BOXED paragraph.

PART II

Refer to the shown coordinate system attached to the Pulley;
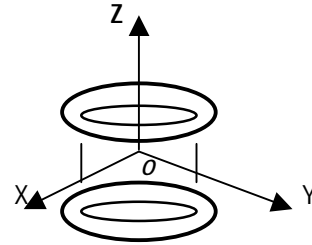
1. Obtain all necessary dimensions for calculation of _VOLUME_ using the appropriate measuring tools.

2. Measure the _MASS_ of the unit.

3. Using the information obtained in steps #1 and #2, determine the MASS and WEIGHT _DENSITIES_ of the material BOTH in SI and USCS units.

4. Compare the DENSITIES of this material with water. Would the Unit submerge in water?   If the Unit has to be submerged in water, what means do you recommend? Explain in a BOXED paragraph.

5. Calculate the Mass Moment of Inertia of the Unit W/R to the **"Z"** axis (the normal rotation axis).

6. If the material of the unit changes to steel, would this change the results in _step #5_ ? If so, by what Ratio? Explain in a BOXED paragraph.

7. If Aluminum 6061-T6 is used as the material of the unit and a TORQUE of _200 lb-in_ is applied W/R to the Z-axis, what would be the angular acceleration of the pulley?

8. Using _Pro-Engineer_;

     a) Create an Isometric Drawing of the unit with all necessary dimensions for _fabrication_ of the unit (use a scale of 1:1). Assume the material is Aluminum 6061-T6.
     b) Generate _Black and White / Color_ hard copies for step **"8-a".**
     c) Use _Pro-E_ functions to obtain VOLUME.
     d) Can _Pro-E_ provide any information about Mass Moment of Inertia?
            Investigate!

9. Recommend an alternative approach for calculation of the VOLUME. Would your recommendation improve the results obtained in step # 3?

PART III

❶ _ALL_ group members must collaborate and contribute in creation of a highly professional technical report addressing all questions and requirements.

❷ _The GROUP (as a UNIT) must fill the "Rating & Assessment" form AFTER completion of this activity and attach as the FIRST page of the report (after cover) ._

❸ Fill up the _CONFIDENTIAL_ member participation forms in a _responsible and ethical_ manner.