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FACULTY OF AERONAUTICS AND AEROSPACE

DEPARTMENT OF AERONAUTICS AND AEROSPACE ENGINEERING

AE 307

MACHINE ELEMENTS AND DESIGN

2024-2025 FALL

SHAFT DESIGN PROJECT REPORT

NAME SURNAME

STUDENT NUMBER

MAIL ADDRESS

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1- SHAFT DESIGN PROBLEM

A shaft with two counter-rotating spur gears will be designed. The gears transmit the torque from another gear, which is connected to them, to the shaft with a key. Gear 1 has diameter d1 and rotates with torque T. Gear 2 has diameter d2 and rotates with torque T. The shaft is also supported by Bearing A and Bearing B at both ends. The dimensions of the shaft were created as a table with separate parameters for each student. Within the parameters and constraints given in the table, calculate and determine the values of D1, D2, D3, and D4 to satisfy the minimum safety factor given in the table, based on providing sufficient fatigue and static stress capacity for infinite life of the shaft. The gears have 20° pressure angle.

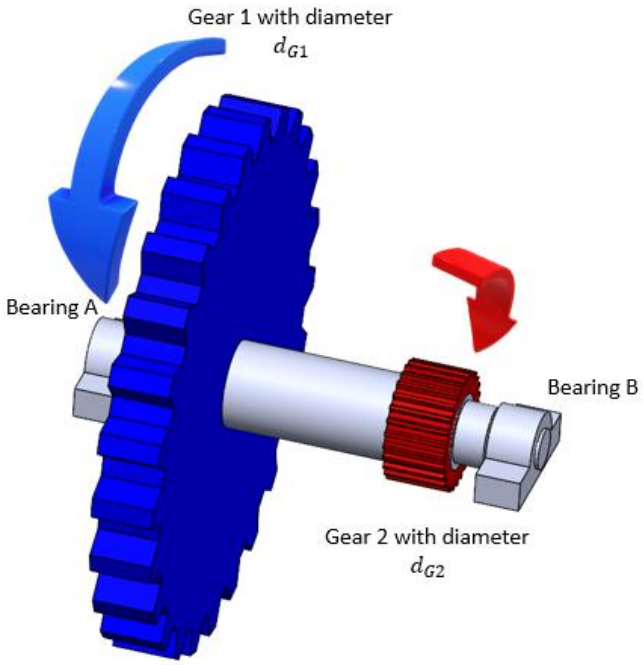

Figure 1: Shaft problem 3D representation.

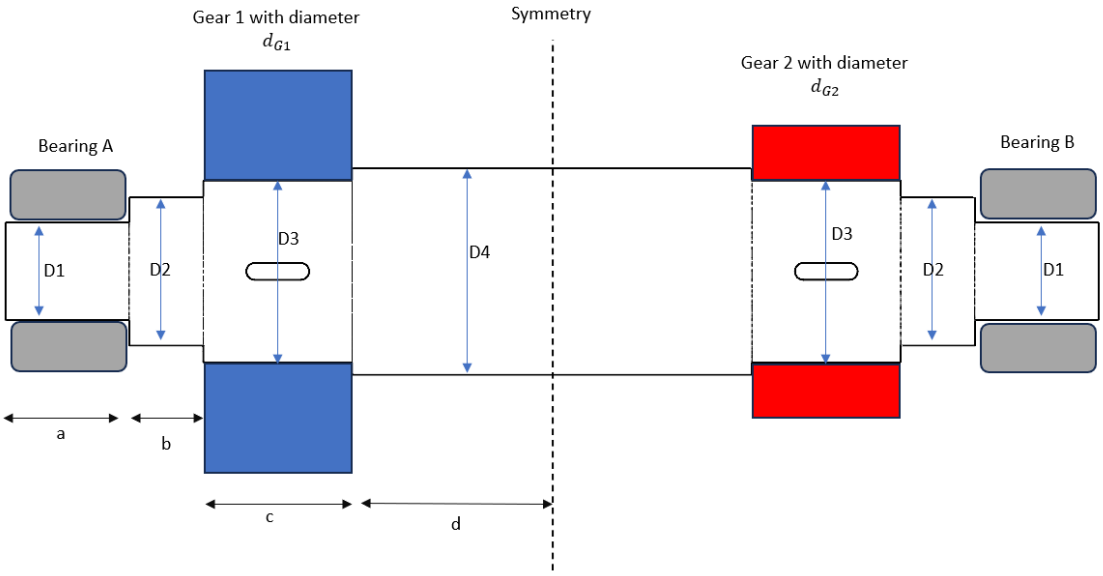

Figure 2: Shaft problem cross-section

- Draw free-body diagram.
- Calculate the tangential and radial components of the gear forces.
- Calculate and draw shear/moment diagram.
- Name the points on shaft. Determine the critical locations and explain why?
- You can choose the material of shaft (AISI 1030HR, 1050CD etc.) by yourself by clearly indicating on your report.
- Use the failure criteria and minimum safety factor specified for you on the table.
- Calculate the diameter for each section D1, D2, D3 and D4, and make sure that they satisfy the minimum safety factor for that section. If the diameter not satisfies the minimum safety factor, try changing the material or increasing the diameter.
- When calculating the force for gears, refer to the center of the gear.
- Since this is a design project rather than a problem solving, you are free to choose any feature or parameter **that is not given or specified**. Clearly indicate the feature or parameter you have chosen in your report.
- After specifying the shaft dimensions, calculate the volume of the shaft and make a weight analysis. In the conclusion section, write your results and write a conclusion paragraph including your comment about your shaft design.

2- SOLUTION PROCESS

3- CONCLUSION

Table 1: Diameters of sections results

D1	
D2	
D3	
D4	