

MCTA 2332 MECHANISM AND MACHINE DESIGN

ASSIGNMENT 7

*This assignment is a group work with 2 students per group.
Please scan your solution and upload on Microsoft Teams.
Submission due date and time: 11/6/2024, 11.59pm.*

QUESTION 1

The shaft illustrated in **Fig. 1** supports two gears. The shaft is made from high carbon steel, AISI 1018 HR. Both forces $P_A = 3000$ N and P_C act in y direction.

- a) Design the shaft with the initial value of $d = 40$ mm and safety factor of 2.5. Assume end mill keyseat.

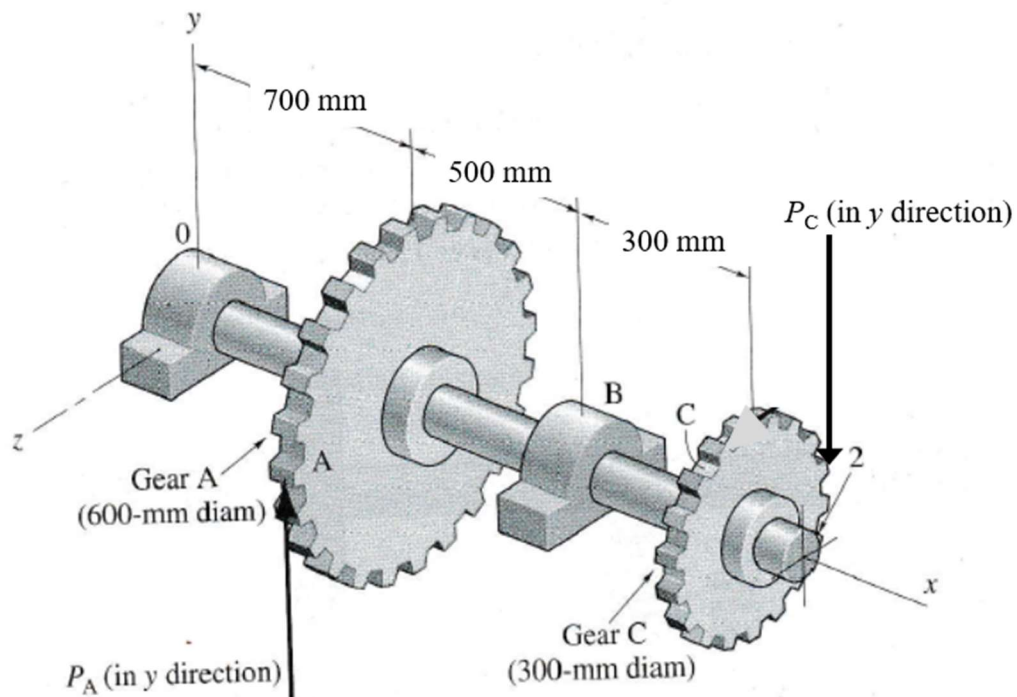


Fig. 1

QUESTION 2

- a) There are two column designs under consideration. The first design is to have a column with a square cross section with dimension $15\text{ cm} \times 15\text{ cm}$ and in the second the design, the cross section will be a rectangular with dimension $18\text{ cm} \times 13\text{ cm}$. Both designs are to have 1.5 m length, both ends pinned, made of AISI 1006 steel material with yield strength, $S_y = 170$ MPa and Young Modulus, $E = 207$ GPa. Examine which design is better based on the critical buckling load that it can support.

- b) Determine the solid length, L_s and, and total number of coils, N_t for a spring with squared and ground ends, number of active coils, $N_a=10$, spring index, $C=10$, mean coil diameter, $D=40\text{mm}$.
- c) A speed reducer has 30° full-depth teeth and consists of a 30-tooth steel spur pinion driving a 70-tooth cast-iron gear. The power transmitted is 15 kW at a pinion speed of 1600 rev/min. For a module of 8 mm and maximum contact stress of -450 MPa, suggest a suitable face width.