Numericals on Power Transmission

Basic Numerical on Gears

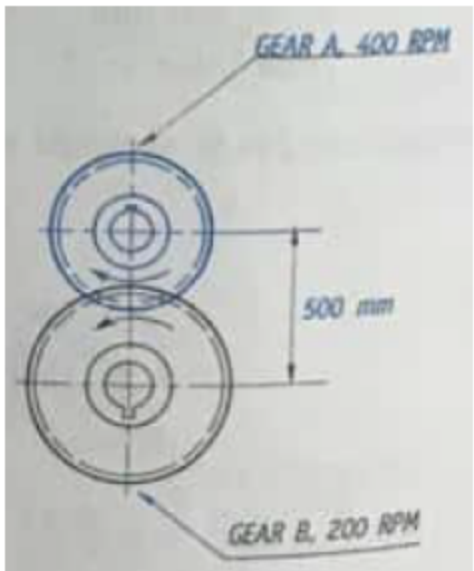
1. A gear wheel of 20 teeth drives another gear wheel having 36 teeth running at 200 rpm. Find the speed of the driving wheel and the velocity ratio

- Solution:
- Data: $T_1 = 20$, $T_2 = 36$, $N_2 = 200$ rpm
  - Velocity ration $N_1/N_2 = T_2/T_1$
  - Therefore $N_1/N_2 = 36/20 = 1.8:1$
  - Driving Speed $N_1 = N_2 \times T_2/T_1 = 200 \times 36/20 = 360$ rpm

2. A gear wheel has 50 teeth of module 5 mm. Find the pitch circle diameter and the circular pitch.

- Solution:
  - Data: T = 50, m = 5 mm, pitch circle diameter = d = ? , Circular pitch = ?
  - We know that, Module is given by
  - $m = d/T$
  - Therefore pcd = d = m x T = 5 x 50 = 250 mm
  - Circular pitch = $P_c = \pi d/T = \frac{\pi x 250}{50}$
  - $P_c = 15.7$ mm

3. Two spur gears A and B connect two parallel shafts that are 500 mm apart. Gear A runs at 400 rpm and Gear B at 200 rpm. If the circular pitch is given to be 30 mm, calculate the number of teeth on gears A and B.



- Solution:
  - Data: $N_A = 400$ rpm, $N_B = 200$ rpm, $P_c = 30$ mm
  - Gap = $(d_A + d_B)/2 = 500$ mm
  - T_A = ? And T_B = ?
  - Velocity ratio = $N_A/N_B = d_b/d_A$
  - Therefore $400 / 200 = d_B/d_A$
  - $d_B = 2 \times d_A$
  - Solving for the diameters, we get $d_A + d_B = 1000$
  - Therefore, $d_A = 333.33$ mm and $d_B = 666.67$ mm

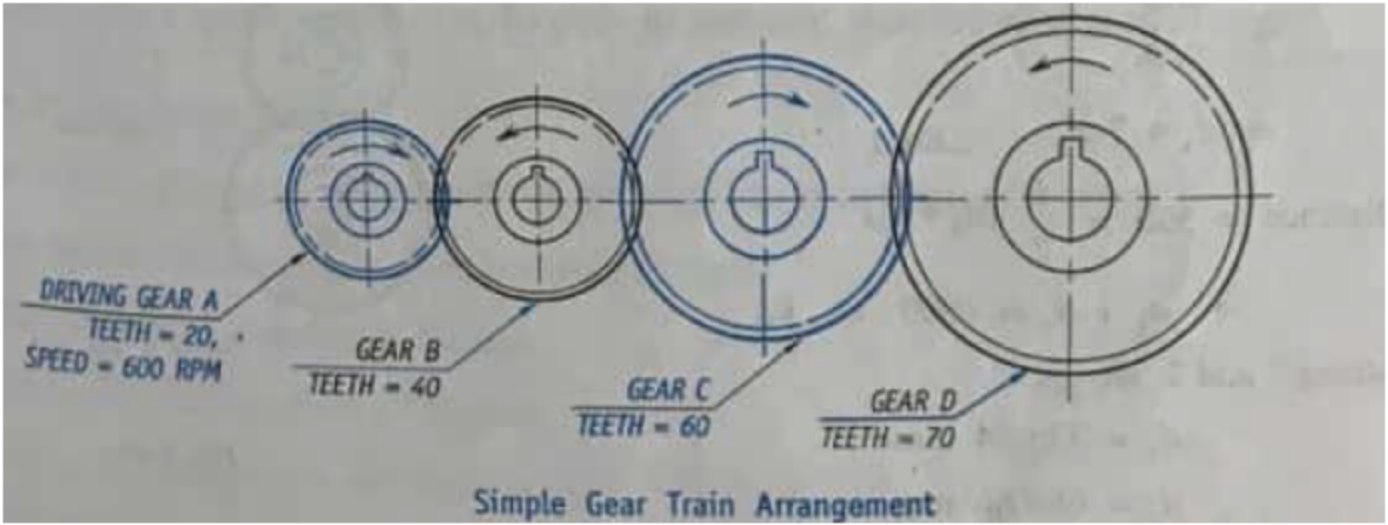
- Number of teeth of gear A
- TA = $_{\pi}d_{A/Pc}$ = $\pi x 333.33/30$
- TA = 35 teeth

- Speed ratio = $N_A/N_B = T_B/T_A$
- T_B = 35 x 400 / 200
- T_B = 70 teeth

4. A simple gear train is made up of four gears A, B, C and D having 20, 40, 60 and 70 teeth respectively. If gear A is the main driver rotating at 500 rpm clockwise, calculate the following:
   i. Speeds of intermediate gears
   ii. Speed and direction of the last follower
   iii. Train Value

- Solution

  - Data: $N_A = 500$ rpm, $T_A = 20$, $T_B = 40$, $T_C = 60$ and $T_D = 70$
  - To find: Train Value = ? , N_B = ?, N_C = ?, N_D = ?



Simple Gear Train Arrangement

- Using Velocity ratio formula: $N_A/N_B = T_B/T_A$
- Therefore $N_B = N_A \times T_A/T_B = 500 \times 20/40 = 250$ rpm

- Similarly
- $N_B/N_C = T_C/T_B$
- $N_C = N_B \times T_B/T_C = 250 \times 40/60 = 166.67$ rpm ($N_C = 167$ rpm)

- And $N_C/N_D = T_D/T_C$
- $N_D = N_C \times T_C/T_D = 167 \times 60/70 = 142.8$ rpm ($N_D = 143$ rpm)

- Train Value = 1/Velocity Ratio = N_D/N_A
- Train Value = 143/500 = 0.286

- Homework

5. A compound gear train consists of 4 gears A, B, C and D and they have 20, 30, 40 and 60 teeth respectively. A is keyed to the driving shaft and D is keyed to drive shaft , B and C are compound gears, B meshes with A and C meshes with D. If rotates at 180 rpm, find rpm of D