Numericals on Gear drives

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

- Solution   T1= 20 T2 = 36 N1= ? N2= 200

- $N_2/N_1 = T_1/T_2$

- 200/N1 = 20/36

- N1= 360 rpm.

- Velocity ratio = N2/N1= 200/360

3. 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, B and C are compound gears, B meshes with A and C meshes with D. If A rotaes at 180 rpm find the rpm of D.

- Solution T_A = 20 T_B = 30 T_C = 40 T_D = 60 N_A= 180 N_B= 200
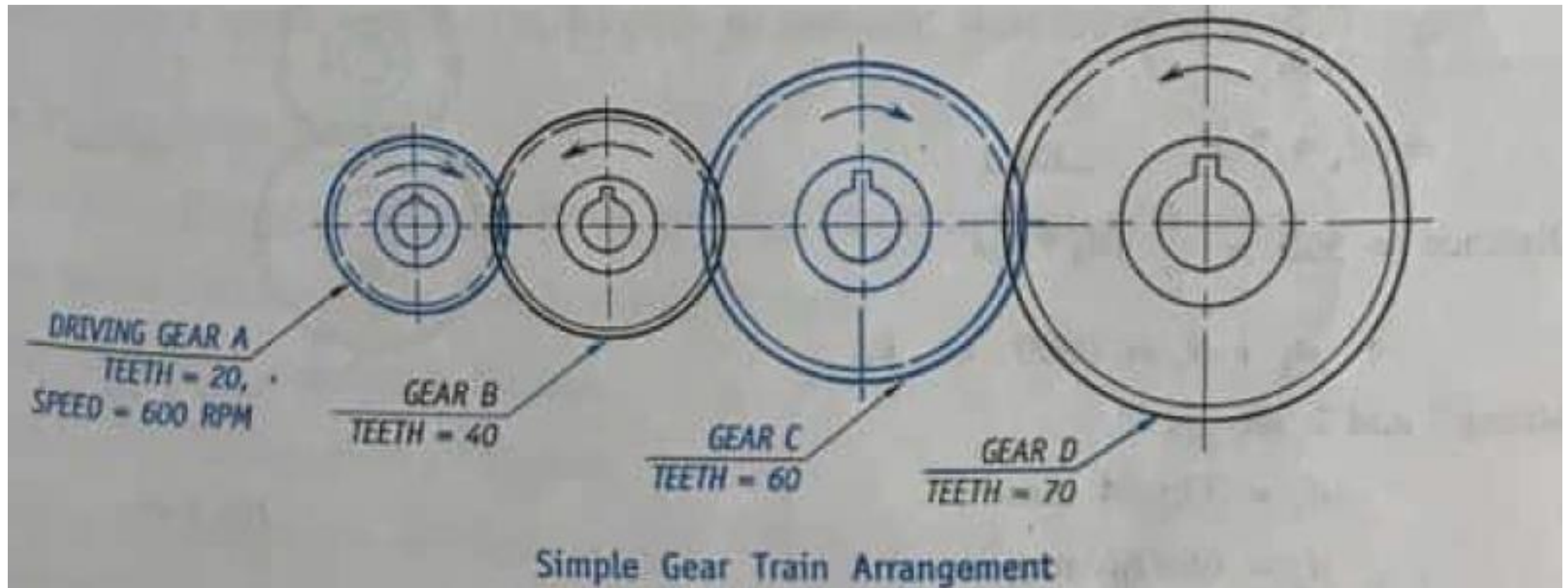- N_D/N_A = (T_A/T_D)* (T_C/T_B)
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- N_D= 80 rpm.

3. 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

DRIVING GEAR A
TEETH = 20,
SPEED = 600 RPM

GEAR B
TEETH = 40

GEAR C
TEETH = 60

GEAR D
TEETH = 70

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

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

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

- Train Value = 1/Velocity Ratio
- Velocity ratio = N_D/N_A

= 143/500 = 0.286

Train Value= 1/0.286 = 3.5.

A spur gear 1 mounted on shaft A has 120 teeth and drives a spur gear pinion 2 having 15 teeth mounted on shaft B. Compounded with gear 2 is a 75 tooth spur gear 3 which drives a 20 tooth spur gear 4 mounted on shaft C. Mounted on the same shaft as gear 4 is a 144 tooth spur gear 5 driving a spur gear 6 which is mounted on shaft D with 172 teeth which is co-linear with the axis of shaft A. All shafts are parallel and in the same plane.

Make a sketch of the gear train and identify components. If the gear 1 runs at 500 rpm find the velocity ratio of the gear train and speeds of all other gears.