

Assignment # 1, Gears

1. In a pair of spur gears, the number of teeth on the pinion and the gear are 20 and 100 respectively. The module is 6 mm. Calculate:

- i) The center distance; ii) The pitch circle diameter of pinion and gear;
- iii) Addendum and Dedendum; iv) The gear ratio.

2. A pair of spur gears with a center distance of 495 mm is used for a speed reduction of 4.5 : 1. The module is 6 mm. Calculate the number of teeth on the pinion and the gear.

3. The layout of a two-stage gearbox is shown in (Figure 1). The number of teeth on the gears are as follows:

$$N_1 = 20, N_2 = 50, N_3 = 20, N_4 = 50$$

Pinion 1 rotates at 1440 rpm in an anticlockwise direction when observed from the left, and transmits 10 kW power to the gear train.

Requirements:

- a) Find the output shaft rotational speed in rpm.
- b) Draw a free-body diagram of the gear tooth forces and determine the reactions at bearings E and F.

4. A planetary gear train is shown in (Figure 2). The sun gear A rotates in a clockwise direction and transmits 5 kW power at 1440 rpm to the gear train. The number of teeth on the sun gear A, the planet gear B, and the fixed ring gear C are 30, 60, and 150 respectively. The module is 4 mm and the pressure angle is 20° .

Requirements:

- c) Find the rotational speed in rpm of the Planet gear B, and the arm D.
- d) Draw a free-body diagram of the forces acting on each gear and determine the torque that the arm D can deliver on its output shaft.

5. It is required to design a pair of spur gears with 20° full-depth involute teeth. The input shaft rotates at 720 rpm and receives 5 kW from an electric motor for a small power drill, through a flexible coupling. The speed of the output shaft should be 144 rpm.

6. It is required to design a single or multi-stage gearbox using spur gears with 20° full-depth involute teeth. The input shaft rotates at 1200 rpm and receives 45 kW from a diesel engine for a cement mixer. The speed of the output shaft should be 70 rpm.

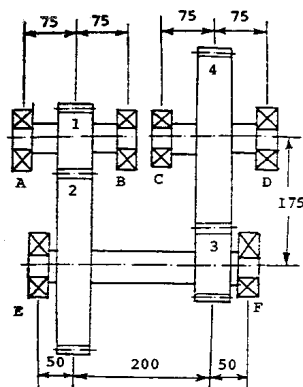


Figure 1

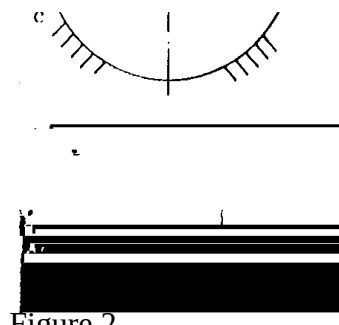


Figure 2