

# Problem of Practices on Mechanical Engineering Design Chapter-8 Gears

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1. A gear box for a drilling machine is to be designed to provide spindle speeds in the range of 100 r.p.m. to 640 r.p.m in 9 steps arranged in the geometric progression. Calculate the speeds which may be rounded off to the nearest 5 r.p.m. Sketch a schematic diagram of arrangement of gears.
2. A drilling machine gearbox has to have six speeds based of R 10 series, with maximum output speed of 1800 r.p.m. the input speed to the gearbox is also 1800 r.p.m. The gearbox has three shafts. There are three speed changes between the input shaft and intermediate shaft and two speed changes between the intermediate and output shafts.
  - (i) Determine the designed gear ratios.
  - (ii) Determine the number of teeth in each gear pair.
  - (iii) Determine the gear ratios based on the number of teeth in each gear-pair.
3. An electric motor running at 500 rpm drives a low speed pump with a reduction of 1.8 : 1 through a pair of spur gears, which have teeth of  $14\frac{1}{2}^\circ$  involute form (module = 6 mm). The pinion has 20 teeth. In order that the interference does not take place, find
  - (i) the maximum working depth,

- (ii) the lengths of path of contact arc of contact,
  - (iii) the maximum velocity of sliding on either side of pitch point.
4. Two shaft  $A$  and  $D$  are in the same line (axes in one line). They are geared together through an intermediate parallel shaft carrying wheels  $B$  and  $C$  which mesh with the wheels on  $A$  and  $D$  respectively. Wheels  $A$  and  $B$  have a module of 4 mm and wheels  $C$  and  $D$  have a module of 9 mm. The number of teeth on any wheel is to be not less than 15 and the speed of  $D$  is to be about, but not greater than  $1/12$  the speed of  $A$  and the ratio each reduction in the same. Find
- (i) suitable number of teeth for the wheels,
  - (ii) the actual reduction, and
  - (iii) the distance of the intermediate shaft from the axes of the shafts  $A$  &  $D$  (centre distance). Indicate the configuration with a sketch.
  - (iv) What is addendum modification related to correction of gears and when are they are used in practice?
- (Gear  $A$  is on shaft  $A$  and gear  $D$  is on shaft  $D$ )
5. Two gears having an angular velocity ratio of 3 : 1 are mounted on shafts whose centers are 136 mm apart. If the module of the gears is 4 mm, how many teeth are there on each gear?
6. Briefly explain the role of idle gears in a simple gear train, with the help of neat sketches.
7. A pair of standard spur gears has 16 and 18 teeth, module 12.5 mm and pressure angle  $14.5^\circ$ . Examine whether the pair will have Interference. If so, what should be the number of teeth in both the gears to avoid interference as well as the pair maintains the same speed ratio without modifying other parameters. Evaluate contact ratio for the new set.
8. Write a brief comment on the holding torque acting on epicyclic gear train casings.
9. In a pair of mating spur gears, the pitch-diameter of smaller gear is 120 mm. The pair is of standard gear involute having module as 8. If the transmission ratio between the gears is 4 : 3, then find out
- (i) Number of teeth on gear,
  - (ii) Number of teeth on pinion,
  - (iii) Addendum,
  - (iv) Dedendum,
  - (v) Whole depth, and
  - (vi) Clearance.
10. The data for 2 sets of spur gears are given below

|                            | Set-1      | Set-2      |
|----------------------------|------------|------------|
| Pressure angle             | $20^\circ$ | $20^\circ$ |
| No. of teeth in Large gear | 40         | 50         |
| No. of teeth in Pinion     | 20         | 13         |
| Module                     | 10 mm      | 10 mm      |
| Addendum                   | 1 module   | 1 module   |

Check for the occurrence of Interference. If it occurs, what is the pressure angle to correct it?