

# MACHINE TOOL DESIGN

MAY 2015

(REVISED COURSE)

(3 Hours)

QP Code : 5039

[Total Marks : 80]

JP-Con: 12455-15

- N.B.: (1) Question No.1 is compulsory and answer any THREE from the remaining FIVE questions.  
(2) Use of PSG Design Data Book is permitted.  
(3) Make appropriate assumptions, wherever necessary  
(4) Illustrate your answers with neat sketches.

1. A nine speed gearbox has input motor of 10 HP and 1400 rpm. The maximum and Minimum speeds are 1000 and 150 rpm respectively. 20  
Draw (i) Optimum structural diagram (ii) Optimum ray diagram (iii) Gearing diagram (iv) Deviation diagram.
2. (a) Write short note on recirculating ball screw for power transmission. 5  
(b) Design lead screw of a machine tool to carry 8000 N axial load. The length of lead screw is 1.5 meters 15  
and its speed is 50 rpm. The design should be based on strength, stiffness and Buckling.
3. (a) Describe with neat sketch the working principle of multi-plate friction clutch. 5  
(b) Design a clutch to connect a geared motor to a centrifugal pump. The clutch is to be rated for 5 HP at 15  
750 rpm. It is operated nearly 6000 times a year and works only one shift per day.  
Make suitable assumptions and state them clearly.
4. (a) Write short note on materials used for bearings and their applications. 5  
(b) A full journal bearing supports a load of 30 kN. The shaft speed is 1500 rpm. Calculate : - 15  
(i) Length, diameter and minimum clearance of bearing. (ii) Oil viscosity and coefficient of friction.  
(iii) Power loss in friction  
(iv) Amount of oil to be circulated such that increase in oil temperature is limited to 30 degrees centigrade
5. (a) Write short note on mounting of bearings. 5  
(b) A deep groove ball bearing with a dynamic capacity of 35000 N is fatigue cycled as below : 15
- | Axial Load | Radial Load | RPM  | % cycle time |
|------------|-------------|------|--------------|
| 2000 N     | 4000 N      | 800  | 25           |
| 1800 N     | 3500 N      | 1200 | 40           |
| 2400 N     | 4200 N      | 1250 | 35           |
- Determine: (i) Cubic mean load. (ii) The 90 % life of bearing in hours. (iii) Average life in hours.
6. Write short note on any four : - 20  
(a) Wear compensation of slide ways. (b) Acceptance tests on machine tools.  
(c) Bed and column sections in machine tools. (d) PIV drive.  
(e) Norton gear box drive.