

NB: (1) Question No. 1 is compulsory.

(2) Attempt any **THREE** questions from the remaining.

(3) Use of PSG Design Data Book is permitted.

(4) Make appropriate assumptions, wherever necessary.

(5) Illustrate your answers with neat sketches.



1. Design a 3 stage, 12 speed Gear Box for a machine tool from the following particulars: 20
- Minimum output speed = 140 rpm
Maximum output speed = 1100 rpm
Input motor power = 8 kW
Motor speed = 1400 rpm.
- Design the shaft sizes, arrangement of gears and their sizes. Also draw the structural diagram, optimum ray diagram and deviation diagram. Prepare a neat sketch depicting the layout of the gear box with relevant details.
2. (a) Discuss the step to step procedure for designing a V-belt drive. 08
(b) Design a lead screw and nut for a lathe to sustain an axial load of 12 kN. The lead screw is to be 2.6 m long and is to rotate at 65 rpm. The coefficient of friction at the collar and threads could be taken as 0.12 and 0.14 respectively. 12
3. (a) Discuss the various materials used for clutch design. 05
(b) Design and sketch a multi-plate clutch used in a metal cutting machine tool with a power transmitting capacity of 12kW at 1000 rpm. The clutch is to be operated 100 times in an 8 hour shift. The design should include the discs and the operating lever. Assume appropriate data from hand book, clearly specifying the same. 15
4. (a) Discuss with sketches various acceptance tests carried out on a lathe. 08
(b) Design a journal bearing to be used on a shaft which is meant to transmit 6 HP at 900 rpm. Radial load on journal is 8kN, direct angle on the bearing is 180°. The bearing surface temperature is to be maintained at 60°C. 12
5. (a) Discuss the wear compensation techniques used in slideways. 08
(b) A deep groove ball bearing with dynamic capacity of 30kN is loaded as shown: 12

Axial Load (N)	Radial Load (N)	rpm	%cycle time
3000	3000	1200	25
2000	2500	1100	35
4000	2000	1000	40

Determine: Cubic mean load, 90% life of bearing in hours, Average life of bearing in hours.

6. Write explanatory notes on any **four** of the following:- 20
- (a) Anti-friction guideways.
(b) Types of belts and materials of construction.
(c) Norton gear box.
(d) Bed and column sections used in machine tools.
(e) Machine tool safety requirements.
