

Con. 5322-09.

SP-8015

(3 Hours)

[ Total Marks : 100

- N.B. (1) Question No. 1 is **compulsory** and attempt any **four** questions from the **remaining**.  
 (2) Use of PSG Design Data Book is **permitted**.  
 (3) Make appropriate assumptions, wherever necessary.  
 (4) Illustrate your answers with **neat** sketches.  
 (5) **Figures** to the **right** indicate **full** marks.

1. Design a two stage, six speed Gear Box for a machine tool from the following **20** particulars :

- Minimum out put speed = 200 rpm  
 Maximum out put speed = 1000 rpm  
 Input motor power = 10 kW  
 Motor speed = 1440 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) Explain Bearing Characteristic Number and its significance in design of journal bearings. **5**

(b) A full journal bearing is to be designed to support a load of 20 kN. The shaft is to operate at a speed of 1000 rpm. It is desired to operate the bearing at a surface temperature not exceeding 75 °C in a room temperature of 35 °C. Assume appropriate materials for the shaft and the bearing.

Determine :

- (i) Length, diameter and clearance of the bearing **4**  
 (ii) Oil viscosity and coefficient of friction **4**  
 (iii) Power loss in overcoming friction at the bearing. **3**  
 (iv) Quantity of oil required to be circulated to maintain the bearing surface temperature. **4**

3. (a) Design a lead screw and nut for a lathe to sustain an axial load of 15 kN. **15**  
 The lead screw is to be 1.25 m long and is to rotate at 30 rpm. The coefficient of friction at the collar and threads could be taken as 0.11 and 0.14 respectively.

(b) Determine the efficiency of the screw that you have designed and prepare a neat sketch showing the mounting details of the screw. **5**

4. (a) Discuss the different bearing materials and their characteristics. **5**

(b) A 50 mm diameter machine shaft is to be supported at the ends by ball bearings. **15**  
 It operates 8 hours/day, 320 days a year for 10 years life. For the loads and speed cycle for the bearing, as given below, select a suitable bearing from the hand book.

No.	Radial Load (N)	Axial Load (N)	Speed (rpm)	% of Cycle Time
1	3500	2000	1200	0.3
2	2500	2000	1600	0.4
3	4000	2000	900	0.3

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5. (a) Discuss the various considerations to be made in designing a friction clutch. 6  
(b) A multiplate clutch for machine tool operation is to be designed to run dry. 14  
The driving discs are to be made of phosphor bronze, while the driven discs are to be made of hardened steel. The clutch is to be operated 50 times in an eight hour shift. The power transmitting capacity of the clutch is to be 7.25 kW at 125 rpm.  
Design and sketch the clutch. The design should include the discs and the operating lever. Assume appropriate data from hand book, clearly specifying the same.
6. (a) Enumerate with sketches Acceptance tests carried out on (i) Lathe (ii) Milling machine. 14  
(b) Discuss with the help of neat sketches various techniques employed for wear compensation in slide ways. 6
7. Write explanatory notes on any **four** of the following :— 20  
(i) Slide ways used in Machine Tools.  
(ii) Beds and column sections used in Machine Tools.  
(iii) PIV Drives.  
(iv) Rolling friction power screws.  
(v) Hydrostatic and Hydrodynamic bearings.
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