Q. P. Code: 18537

(3 Hours)   Total Marks: 80

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 two stage, 9 speed Gear Box for a machine tool from the following   **20**
    particulars:
        Minimum output speed = 200 rpm
        Maximum output 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) Discuss the step to step procedure for designing a flat belt pulley.   **08**
    (b) Design a lead screw and nut for a lathe to sustain an axial load of 10 kN. The lead   **12**
        screw is to be 2 m long and is to rotate at 50 rpm. The coefficient of friction at the
        collar and threads could be taken as 0.12 and 0.14 respectively.

3.   (a) Discuss the various safety devices incorporated in machine tools.   **05**
    (b) Design and sketch a multi-plate clutch used in a metal cutting machine tool with a   **15**
        power transmitting capacity of 8kW at 800 rpm. The clutch is to be operated 80 to
        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.

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 7HP at   **12**
        950 rpm. Radial load on journal is 8kN, direct angle on the bearing is 180^0. The
        bearing surface temperature is to be maintained at 60^0C.

5.   (a) Discuss the various slideway profiles with applications..   **05**
    (b) A deep groove ball bearing has dynamic capacity of 40 kN. It is subjected to the   **15**
        following duty, during one cycle of operation.
        1. Radial load of 3000N at 400 rpm for 25% of time
        2. Radial load of 6000N at 600 rpm for 40% of time
        3. Radial load of 1000N at 600 rpm for rest of the time
        4. Constant axial load of 3000N.
        Determine: Cubic mean load, Rated life of bearing in hours, Average life of
        bearing in hours.

6.   Write explanatory notes on any **four** of the following:-   **20**
    (a) Wear compensation techniques in a slideway.
    (b) Types of belts and materials of construction.
    (c) PIV drives.
    (d) Bed and column sections used in machine tools.
    (e) Machine tool structure requirements and design guidelines.

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