MD-Con: 12059-15   (REVISED COURSE)   QP Code : 6476

(3 Hours)   [Total Marks : 80]

N.B.: (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 particulars :   20
     Minimum output speed = 150 rpm, Maximum output speed = 1000 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 & deviation diagram. Prepare a neat sketch depicting the layout of the gear box with relevant details.

2. (a) Write a short note on rolling friction power screws.   5
   (b) Design a lead screw and nut for a lathe to sustain an axial load of 8 kN. The lead screw 15 is to be 2m   15
     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 considerations to be made in designing a friction clutch.   5
   (b) Design and sketch a multi-plate clutch used in a metal cutting machine tool with a power transmitting   15
     capacity of 8kW at 1000 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) What is the procedure adopted in designing a journal bearing?   5
   (b) A full journal bearing is to be designed to support a load of 5 kN. The shaft is to operate at a speed of   15
     1000 rpm. The spindle transmits 8 HP. It is desired to operate the bearing at a surface temperature not
     exceeding 75°C in a room temperature of 35 °C. 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

5. (a) Discuss the different bearing materials and their characteristics.   5
   (b) A deep groove ball bearing has dynamic capacity of 44 kN. It is subjected to the following duty,   15
     during one cycle of operation.
       (i) Radial load of 4000N at 400 rpm for 20% of time
       (ii) Radial load of 8000N at 600 rpm for 20% of time
       (iii) Radial load of 10000N at 600 rpm for rest of the time
       (iv) 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) Slideways.   (b) Types of belts and materials of construction.
   (c) PIV drives.   (d) Bed and column sections used in machine tools.
   (e) Role of a machine tool designer.