

MEM51 Design of Machine Elements

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REG. NO

OCTOBER 2021

Time: Three hours

Maximum Marks: 75

- Note:
1. Answer ALL the questions by either or choice.
 2. Each question carries 15 marks.
 3. Design data book approved by DOTE and Chairman, Autonomous examination are permitted.
 4. The question paper contains TWO Pages

1. UNIT I

- a) A mild steel rod supports a tensile load of 50KN. If the stress in the rod is limited to 100N/mm^2 , determine the size of the rod when the cross section is circular. (5)
- b) A hydraulic press exerts a total load of 3.5MN. The load is carried by two steel rods supporting the upper head of the press. If the safe stress is 85MPa and $E= 210 \text{ KN/mm}^2$. Find (i) diameter of the rods (ii) extension in each rod in a length of 2.5m. (10)

[OR]

2. Design a sleeve and cotter joint to connect two rods for transmitting a maximum tensile load of 120KN. The rods, sleeve and cotters are made of same material and the permissible stresses in the material are 175N/mm^2 in tension, 280 N/mm^2 in compression and 130 N/mm^2 in shear. (15)

UNIT-II

3. A shaft of 30KW, 710 rpm motor is supported in bearings 500mm apart. Armature weight of 10KN is concentrated and acting vertically at the centre of the shaft. Determine diameter of the shaft. Take allowable shear stress as 40 N/mm^2 . (15)

[OR]

4. (a) Sketch a woodruff key. Mention its application. (5)
(b) Design a rectangular key for a mild steel shaft transmitting 16KW at 900 rpm. The diameter of the shaft is 40mm and length of the key is 80mm. The shear and the crushing stress for mild steel are 52 N/mm^2 and 116 N/mm^2 respectively. (10)

UNIT-III

5. Design a flat belt drive to transmit 22.5 KW at 740 rpm to an aluminum rolling machine. The speed ratio is 3. The distance between the pulley is 3m. Diameter of rolling machine pulley is 1.2m. Use manufacturer's data. (15)

[OR]

6. Design a V-belt drive using manufacturer's data to the following specifications.

Power to be transmitted = 7.5KW
Speed of driving pulley = 1000rpm
Speed of driven pulley = 300rpm
Diameter of driving pulley = 150mm
Diameter of driven pulley = 500mm
Centre distance between pulley = 925mm
Service – 16hrs/day.

(15)

7. UNIT-IV

- (a) How bearing are classified? (5)
- (b) A 75mm journal bearing 100mm long is subjected to 2.5KN at 600rpm. If the room temperature is 24°C, what viscosity of oil should be used to limit the bearing surface temperature at 55°C. Take $D/C=1000$. Bearing is used for light and medium construction. (10)

[OR]

8. Design a suitable journal bearing for a centrifugal pump from the following data.

Load on the bearing	= 14KN
Diameter of journal	=80mm
Speed	= 1440rpm
Bearing characteristic number	= 30×10^{-6}
Permissible bearing pressure	=0.7 to 1.4N/mm ²
Average Atmospheric temperature	= 30°C

Calculate the Cooling requirements using Lache's equation. Use McKee's equation for calculating co-efficient. Assume $L/D=2$. (15)

UNIT-V

9. A cranked lever has the following dimensions length of the handle = 400mm, Length of the lever arm = 500mm, overhang of the journal =200mm. If the lever is operated by a single person exerting a maximum force of 500N at a distance of $1/3^{\text{rd}}$ length of the handle from its free end. Find (i) diameter of the handle (ii) cross section of the lever arm which is rectangular $b=2t$ (iii) Diameter of the journal. The permissible bending stress for the lever material may taken as 50MPa and shear stress for the shaft material is 42MPa. (15)

[OR]

10. A pinion runs at 600rpm drives a gear at a speed ratio is 4:1. Allowable static stress of pinion and gear material is 85N/mm². Pinion has 16 teeth of module 8mm. Teeth are 20°FD system, face width 90mm. Find the power transmitted. (15)
