

April 2024

Time - Three hours
(Maximum Marks: 100)

- [N.B. 1. Answer all questions under Part-A. Each question carries 3 marks.
2. Answer all the questions either (A) or (B) in Part-B. Each question carries 14 marks.]

PART - A

1. What are the factors to be considered for the selection of materials?
2. Draw an S - N curve for mild steel.
3. What are the types of failures in keys?
4. What is the effect of keyway on the shaft?
5. Compare flat belt and V belt.
6. Write short notes on belt materials.
7. What are the standard dimensions and designations of ball-bearings?
8. Write short notes on speed reducer.
9. State the applications of CAD.
10. What are the disadvantages of solid modelling?

PART - B

11. (a) (i) How is high speed tool steel designated?(4)
(ii) A tie-bar has to carry a load of 120 kN. What must be the width of the bar of 13 mm thick, if there is a rivet hole of 20 mm diameter on its centre line? Working stress for the tie-bar is 75 N/mm^2 .(10)
(Or)
(b) Design a sleeve and cotter joint to withstand a tensile load of 70kN. All parts of the joint are made of same material and the permissible stresses are $[\sigma_t] = 60 \text{ N/mm}^2$; $[\sigma_d]=120 \text{ N/mm}^2$; $[\tau]= 70 \text{ N/mm}^2$.

[Turn over.....

12. (a) A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5 m in diameter and has belt tension 5.4 kN and 1.8 kN on the tight side and slack side of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the centre line of the bearing being 400 mm, find the diameter of the shaft. Assuming maximum allowable shear stress of 42 MPa.

(Or)

- (b) Design an unprotected type of cast iron flange coupling to transmit 15 kW at 200 rpm and having an allowable shear stress of 40 N/mm². The working stress in the bolts should not exceed 30 N/mm². Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for C.I. is 14 N/mm².

13. (a) Design a flat belt drive to transmit 22.5 kW at 740 rpm to an aluminium rolling machine. The speed ratio is 3. The distance between the pulleys is 3 m. Diameter of rolling machine pulley is 1.2 m. Use manufacture's data. Assume: Open belt drive and fabric -high speed duck belt.

(Or)

- (b) Design a belt drive to the following specifications. Power to be transmitted is 75 kW, Speed of driving wheel = 1440 rpm, Speed of driven wheel = 400 rpm, Diameter of driving wheel = 300 mm, Centre distance = 2500 mm.

14. (a) (i) Draw and explain needle roller bearing. (4)
(ii) A journal bearing 75mm long supports a load of 7500 N on a 50 mm diameter journal turning at 750 rpm. The diametral clearance is 0.0693 mm. Determine the viscosity of the oil if the operating temperature of the bearing surface is limited to 77°C. The ambient temperature = 12°C. Heat dissipating co-efficient = 210 W/m²/°C. (10)

(Or)

- (b) A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 100 mm and the load on it is 20 KN and its speed is 1200 rpm. Design and give the complete calculations for the bearing.

15. (a) Explain Pahl and Beitz design process.

(Or)

- (b) Explain 2D and 3D Boolean operations with sketches.
