April 2025

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.
3. PSG Design Data Book or Approved Data Book is permitted.]

PART – A

1. Define factor of safety.

2. Define endurance Limit.

3. What are the types of keys?

4. What is the purpose of coupling?

5. Sketch the cross section of V – belt and label its parts.

6. What are the effects of slip?

7. Write about antifriction bearings.

8. Define backlash in gear.

9. State the applications of CAD.

10. What is primitive?

PART – B

11. (a) Design a sleeve and cotter joint to connect two rods for transmitting a maximum tensile load of 100 kN. The rods, sleeve and cotters are made of same material and the permissible stress in the materials are 65 N/mm² in tension, 130 N/mm² in compression and 60 N/mm² in shear.

(Or)

(b) Discuss about the theories of elastic failures.

[Turn over

12. (a) A shaft made of mild steel is required to transmit 100 kW at 300 rpm. The supported length of the shaft is 3m. It carries two pulleys each weighing 1500 N, supported at a distance of 1m from each ends respectively. Assume the safe value of stress as 60 N/mm². Determine the diameter of the shaft.

(Or)

(b) Design a protected type flange coupling to connect two shafts to transmit 7.5 kW at 720 rpm. The permissible shear stress for the shaft, bolt and key materials is 33 N/mm², permissible crushing strength for bolt and key material is 60 N/mm² and permissible shear stress for cast iron is 15 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 3m. Diameter of rolling machine pulley is 1.2m. Use manufacture's data. Assume the following: (i) Load correction factor (K_s) = 1.5 (ii) Pulley correction factor K_d=0.8 (iii) Open belt drive. Use fabric – high speed duck belt.

(Or)

(b) Design a V-belt drive and calculate the actual belt tensions and average stress from the following data: Diameter of driven pulley = 600mm, Diameter of driving pulley = 200mm, Centre distance between pulleys = 1000mm (approximately), Speed of driven pulley = 400 rpm, Speed of driving pulley = 1200 rpm, Power transmitted = 10 kW, Service factor (K_t) = 1.5, Co-efficient of friction (μ) = 0.3

14. (a) (i) A journal bearing 75mm long supports a load of 7500 N on a 50mm diameter journal turning at 750 rpm. The diametral clearance is 0.0693mm. 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)

(ii) What is bearing characteristic number or bearing modulus? (4)

(Or)

(b) Explain the types of gears with neat sketch.

15. (a) Draw and explain the concepts of sequential engineering and concurrent engineering.

(Or)

(b) (i) Compare C- rep and B- rep in solid geometry. (6)

(ii) Explain union, intersection and subtraction used in Boolean operation. (8)