

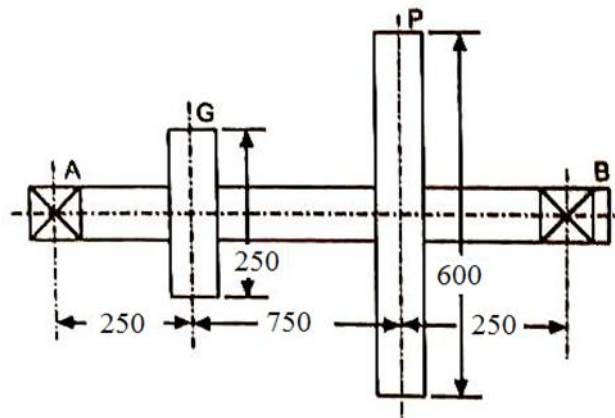
**Total Marks: 80**

**Time: 3 Hours**

**Note:**

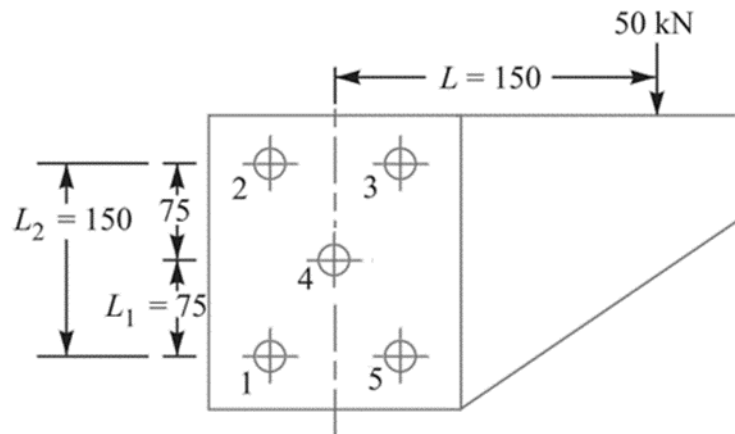
1. Question no. 01 is compulsory.
2. Attempt any three question from the remaining.
3. Assumption made should be clearly stated.
4. Use of standard Design Data Book like PSG, Mahadevan is permitted.

- Q1. Solve any four.** **20**
- a. State the different theories of failure and explain any one in details.
  - b. What do mean by Ergonomics and Aesthetic values in machine design?
  - c. What is nipping in Leaf spring?
  - d. Explain overhauling of screw and self-locking of screw.
  - e. Explain about Notch sensitivity & Endurance Limit.
- Q2 a.** Design a cotter joints to subject to the load of 80 KN. Select the suitable materials for various components. **14**
- b.** What is Stress concentration? What are various causes of stress concentration? **06**
- Q3 a.** A 600 mm diameter pulley driven by a horizontal belt drive transmits power through a solid shaft to a 250 mm diameter gear which drives a mating pinion which transmits torque in vertically downwards direction. The weight of the pulley is 1500 N The shaft transmits a power of 7.5 KW at 650 rpm to the pulley which has horizontal drive. Belt tension in tight side is twice that of the slack side. Determine the shaft diameter by considering suitable material and stresses. Take shock and fatigue factor in shear and bending as 1.5 and 2 respectively. **14**



- b.** What are the classification and application of springs? **06**

- Q4 a.** Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa. The factor of safety based on yield point may be taken as 1.5. **10**
- b.** A bracket is bolted to a column by 5 bolts of equal size as shown in Fig. It carries a load of 50 kN at a distance of 150 mm from the center of column. Determine the diameter of bolt. **10**



- Q5 a.** A screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor-bronze for which the elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm<sup>2</sup>. Design and draw the screw jack. The design should include the design of 1. Screw, 2. Nut, 3. Handle and Cup, and 4. Body. **16**
- b.** Give the classification of various keys. **04**
- Q6 a.** Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.15. Select suitable material and stresses. **12**
- b.** A helical compression spring made of oil tempered carbon steel wire is subjected to an axial load, which varies from 400 N to 1000 N. The spring index is 6. The endurance strength for repeated stress variation and the yield strength may be taken as 350 N/mm<sup>2</sup> and 770 N/mm<sup>2</sup> respectively. Determine **08**
- the wire diameter
  - Spring diameter, for a factor of safety of 1.5.