

1128  
B. E. (Mechanical Engineering)  
Fifth Semester  
MEC-501: Design of Machines Elements – I

Max. Marks: 50

Time allowed: 3 Hours

NOTE: Attempt five questions in all, including Question No. I (Part-A) which is compulsory and selecting atleast two questions each from Part B.C. Assume suitable missing data, if any. Design Data Handbook is not allowed. Supplement your answer with neat and labeled sketches wherever required.

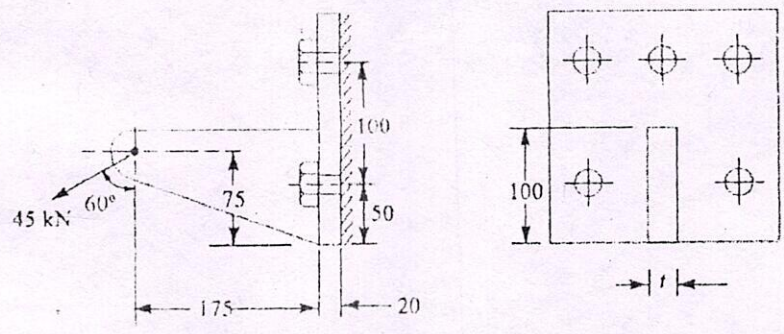
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Part-A

- I (i) Explain the physical significance of various endurance limit modifying factors. (2 Marks)
- (ii) Draw and explain working of a Lozenge joint. (2 Marks)
- (iii) Differentiate between temporary and permanent joints by giving examples. (2 Marks)
- (iv) Name and draw at least two examples of third type of lever. (2 Marks)
- (v) How is overhauling helpful in working of a power screw? (2 Marks)

Part-B

- II Design the fixing bolts and arm of a bracket, shown in next figure, which is fixed to a vertical steel column by means of five standard bolts. Assume safe working stresses of 70 MPa in tension and 50 MPa in shear. (10 Marks)



All dimensions in mm.

- III Use design check approach for checking safety of the 1.5-in-diameter solid mild-steel shaft which is simply supported at the ends as shown in next figure. Two pulleys are keyed to the (10 Marks)



IV A shaft 30 mm diameter is transmitting power at a maximum shear stress of 80 MPa. If a pulley is connected to the shaft by means of a key, find the dimensions of the key so that the stress in the key is not to exceed 50 MPa and length of the key is 4 times the width. (10 Marks)

**Part-C**

V Design and draw a bell crank lever for the Hartnell type governor. The pivots of the bell crank levers of the spring loaded governor are to be fixed at 100 mm radius from the spindle axis. The length of the ball arm of each lever should be 150 mm, the length of the sleeve arm should be 75 mm and the two arms must be at right angles. The mass of each ball is 2 kg. The equilibrium speed in the lowest position of the governor is 300 r.p.m. when the radius of rotation of the ball path is 82 mm. The speed is to be limited to 6% more than the lowest equilibrium speed. The lift of the sleeve, for the operating speed range, is 15 mm. (10 Marks)

VI Design and draw a screw jack for lifting a load of 50 kN through a height of 0.4 m. The screw is made of steel and nut of bronze. Sketch the front sectional view. Allowable stresses for steel may be assumed as: Compressive stress = 80 MPa ; Shear stress = 45 MPa. Allowable stresses for bronze may be assumed as: Tensile stress = 40 MPa ; Bearing stress = 15 MPa; Shear stress = 25 MPa. The coefficient of friction between the steel and bronze pair is 0.12. The screw should have square threads. Design the screw, nut and handle. The handle is made of steel having allowable bending stress 150 MPa. (10 Marks)

VII Discuss the design procedure for designing an square flanged pipe joint. (10 Marks)