

Time allowed: 3 Hours

Max. Marks: 50

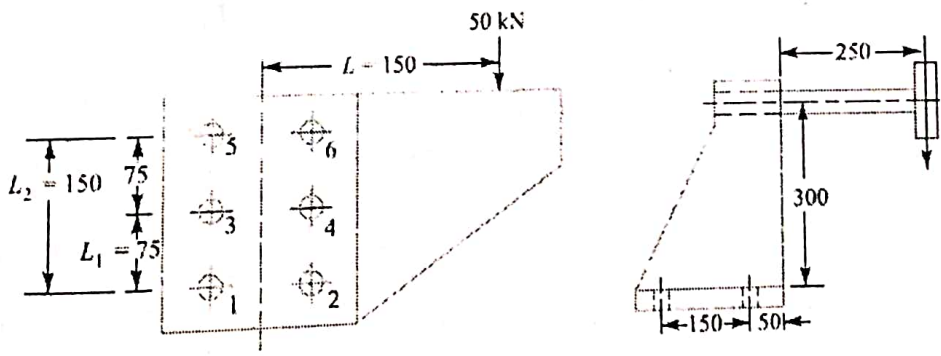
NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Design data handbook is not allowed. Assume suitable the required.

x-x-x

- I
- (i) Compare the safety aspects of Soderberg versus Goodman (2 Marks) criteria.
 - (ii) Differentiate between stud and bolt by drawing sketches. (2 Marks)
 - (iii) Compare the design process applicable for shaft versus axle. (2 Marks)
 - (iv) Name and draw at least two examples of second type of lever.. (2 Marks)
 - (v) How and why do we ensure self-locking in a screw jack? (2 Marks)

Part- A

- II Design the fixing bolts for a bracket which is bolted to a column by 6 bolts of equal size as shown in next figure. It carries a load of 50 kN at a distance of 150 mm from the centre of column. Maximum stress in the bolts is to be limited to 150 MPa. (10 Marks)



All dimensions in mm.

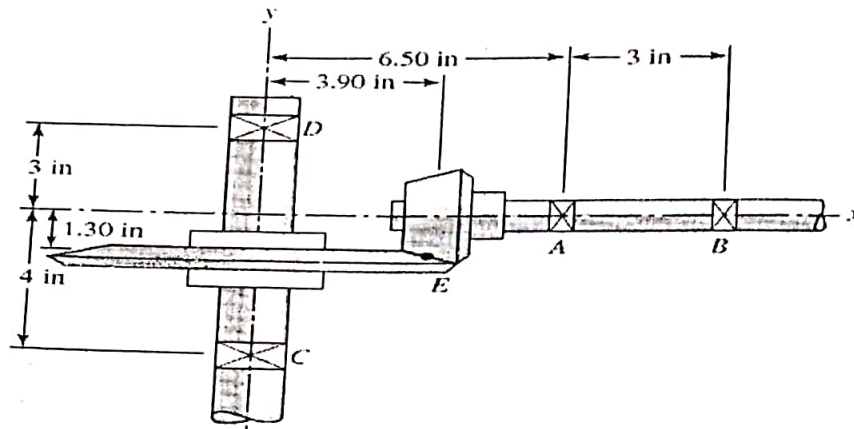
P.T.O.

(2)

III

In the figure shown next, shaft AB is rotating at 1000 rev/min and transmits 10 hp to shaft CD through a set of bevel gears contacting at point E . The contact force at E on the gear of shaft CD is determined to be $(F_E)_{CD} = -92.8\mathbf{i} - 362.8\mathbf{j} + 808.0\mathbf{k}$ lbf. For shaft CD : (a) draw a free-body diagram and determine the reactions at C and D assuming simple supports (assume also that bearing C is a thrust bearing), (b) draw the shear-force and bending-moment diagrams, and (c) assuming that the shaft diameter is 1.25 in, determine the maximum tensile and shear stresses in the beam.

(10 Marks)



IV

Design a muff coupling to connect two shafts transmitting 40 kW at 120 r.p.m. The permissible shear and crushing stress for the shaft and key material (mild steel) are 30 MPa and 80 MPa respectively. The material of muff is cast iron with permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is 25 per cent greater than the mean torque.

(10 Marks)

Part- B

V

The maximum load at the roller end of a rocker arm is 2000 N. The distance between the centre of boss and the load line is 200 mm. Suggest suitable I-section of the rocker arm, if the permissible normal stress is limited to 70 MPa.

(10 Marks)

VI

Design and draw a screw jack for lifting a safe load of 150 kN through a maximum lift of 350 mm. The elastic strength of the material of the screw may be taken as 240 MPa in compression and 160 MPa in shear. The nut is to be made of phosphor bronze for which the elastic strengths in tension, compression and shear are respectively 130, 115 and 100 MPa. Bearing pressure between the threads of the screw and the nut may be taken as 18 N/mm^2 . Safe crushing stress for the material of the body is 100 MPa. Coefficient of friction for the screw as well as collar may be taken as 0.15.

(10 Marks)

VII

Discuss the design procedure for designing an oval flanged pipe joint.

(10 Marks)