Code: 9A03504

R09

B.Tech III Year I Semester (R09) Regular & Supplementary Examinations December 2014
DESIGN OF MACHINE ELEMENTS – I
(Mechanical Engineering)

Time: 3 hours   Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
Use of Design data books is permitted in the examination hall
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1 (a) Distinguish between 'Tolerance' and 'Allowance'.
   (b) Explain clearance and interference fits with examples.
   (c) State the prerequisites for a designer.

2   A cast iron bracket shown in figure-2.6 carries a load of 10 kN at 45^0 to its centre line. The section A-B is a hollow square 100 mm outside. Determine the thickness of the bracket wall if the permissible tensile stress intensity in cast iron is limited to 12.5 N/mm^2.

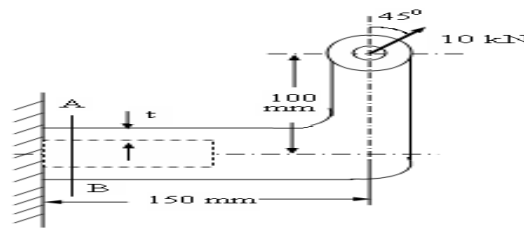Figure – 2.6

3 (a) Distinguish between endurance strength and ultimate strength.
   (b) Determine the size of a piston rod subjected to a total load having cyclic fluctuation from 150 kN (compression) to 25 kN (tension). The endurance limit is 360 MPa and yield strength is 400 MPa. Take factor of safety = 1.5; surface finish factor = 0.88 and stress concentration factor = 2.25.

4   Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to steam pressure of 1 MPa. Assume joint efficiency as 75%, allowable tensile stress in plate as 83 MN/m^2; compression stress as138 MN/m^2 and shear stress in the rivet as 55 MN/m^2.

5   Several members are bolted together in such a manner that the deflection per unit load for the bolted members is the same as for the bolt. Determine: (i) If the initial tightening load on the bolt is 40 kN, what axial external load has to be applied to the bolt to cause separation of the bolted members? (ii) What is the resultant bolt load for an external load of 50 kN? (iii) What is the resultant bolt load for an external load of 100 kN?

6   A driving chain of the type having double strap links of rectangular section transmits 7 kW at a speed of 12 m/min. The depth of the link is four times its thickness and the diameter of the pin at each end is half the depth of the link which is not enlarged or thickened at the ends. Find to the nearest size of mm the sizes of the section of the links and determine the shear and crushing stress on link pins and the maximum tensile stress in the links. The stress in the plain section of the link is 35 MPa and the slack side tension may be taken as zero.

7 (a) Explain the difference between Shaft, Axle and Spindle.
   b) (A shaft transmits 75 kW power at 300 rpm. The distance between the two bearings is 3000 mm. It is subjected to torsion only. Calculate the diameter of the shaft, (i) for steady loading and (ii) for suddenly applied load with minor shocks. Take the allowable shear stress for the shaft material as 35 N/mm^2.

8 (a) When shall you recommend a flexible coupling for connecting shafts? Explain the working of any one type giving a neat sketch of the coupling.
   (b) Calculate the power transmitted by a shaft of 15 mm diameter running at 300 rpm. Two feather keys are fitted to the shaft and the axial force required to slide the outer member along the shaft is 150 N. The coefficient of sliding friction is 0.12.

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