R09

Code: 9A03504

B.Tech III Year I Semester (R09) Supplementary Examinations June 2016
DESIGN OF MACHINE ELEMENTS – I
(Mechanical Engineering)

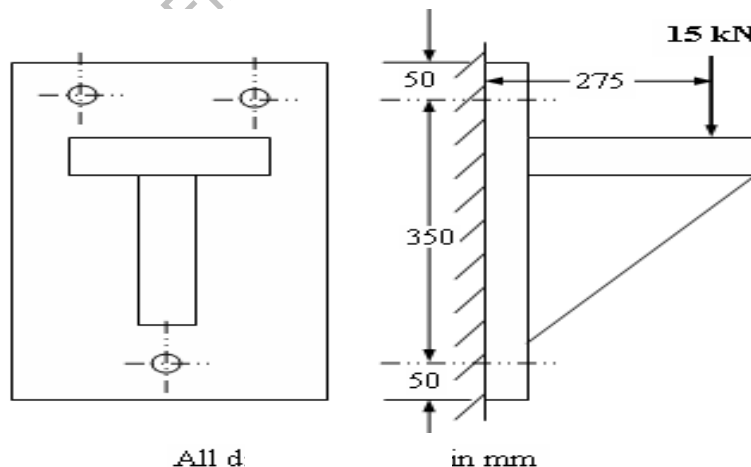Time: 3 hours   Max Marks: 70

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) What are the important considerations that govern the choice of a material?
   (b) What is meant by ductility, malleability and plasticity?

2 (a) A vertical pillar of 50 mm diameter is subjected to a vertical load of 1 kN acting eccentrically at a distance of 30 mm from the axis. Calculate the maximum stress in the pillar and locate it.
   (b) A wrought iron bar 50 mm in diameter and 2.5 m long transmits shock energy of 100 N-m. Find the maximum instantaneous stress and the elongation. Take $E = 200$ GN/m^2.

3 (a) Briefly explain stress concentration and its effects.
   (b) Find the diameter of a shaft to transmit twisting moments varying from 500 N-m to 2000 N-m. The ultimate tensile strength is 600 N/mm^2; yield strength is 450 N/mm^2. Assume stress concentration factor as 1.2, surface finish factor as 0.8, size factor as 0.85 and factor of safety as 2.

4 (a) Sketch and describe: (i) Single riveted lap joint. (ii) Double riveted lap joint. (iii) Double riveted butt joint with double straps. (iv) Triple riveted butt joint with double straps of unequal width.
   (b) How are riveted joints made air tight?

5   Calculate the size of the bolt required for the three hole bracket as shown in figure below. Use coarse threads and the allowable stress of 25 N/mm^2.

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6 (a) Sketch and explain the Cotter joint with Single Gib.
   (b) The pin supporting the exhaust valve lever of an internal combustion engine is subjected to a shear load of 5 kN. Determine the diameter of the pin if the permissible shear stress in the pin material is limited to 40 MPa.

7 (a) Derive an expression for the 'equivalent twisting moment', when a shaft is subjected to both bending moment and twisting moment.
   (b) A 1 m length of commercial steel shafting is to transmit 65 kW at 3600 rev/min through flexible coupling from AC motor to a DC generator. Determine the required shaft size. Assume the allowable shear strength of the shaft material is 40 N/mm^2.

8   A rigid coupling is used to connect a 45 kW, 1440 r.p.m electric motor to a centrifugal pump. The starting torque of the motor is 225% of the rated torque. There are 8 bolts and their pitch circle diameter is 150 mm. The bolts are made of steel 45C8 (S_{yt} = 380 N/mm^2) and factor of safety is 2.5. Determine the diameter of the bolts. Assume that the bolts are finger-tight in reamed and ground holes.

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