Model Question Paper - 2 (CBCS) with effect from 2015-16

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Fifth Semester B.E. Degree (CBCS) Examination
Design of Machine Elements - 1

Time: 3 hrs.   Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
      2. Any data missing may be suitably assumed.
      3. Use of Design Data Hand Book is permitted.

MODULE – I

1 a What are important properties of materials that are to be considered while selecting a material? (8 Marks)

b A cantilever beam of circular cross section and 1 m long is subjected to a transverse load of 30 kN at its free end and an axial load of 60 kN. Find suitable diameter of the rod taking the allowable normal stress as 10 MPa. (8 Marks)

OR

2 a Explain with neat sketches any four cases how to reduce stress concentration in machine members. (8 Marks)

b A stepped shaft with a step ratio 2 and a fillet radius of 10 % of the smaller radius is required to transmit 30kW at 1200 rpm. The allowable shear stress for the material is 60 MPa. Taking stress concentration into account, find the size of the shaft. (8 Marks)

MODULE – II

3 a Derive the equation for axial impact stress. (8 Marks)

b A free end of a cantilever beam of rectangular cross section having depth 200 mm and length 1200 mm, is struck by a weight of 10 kN that falls on to it from a height of 20 mm. The maximum instantaneous is to be limited to 120 MPa. Find suitable width of the cross section. (8 Marks)

OR

4 a Derive Soderberg's equation for fluctuating loads. (6 Marks)

b A connecting rod is subjected to an axial load that fluctuated from 120 kN tension to 60 kN compression. The material has a yield stress of 360 MPa and normal endurance stress o 300 MPa. Taking factor of safety as 2.1, find suitable diameter of the connecting rod. (10 Marks)

MODULE – III

5 A solid shaft 900 mm long between bearings receives 18 kW of power at 900 rpm through a 20^0 involute spur gear of diameter 200 mm, located at 200 mm to the left of left bearing. It is driven by another gear with downward tangential force. The power is transmitted by a 400 mm diameter pulley downward at an angle of 45^0 to horizontal. The pulley is located at 300 mm to the left of right bearing. The tensions' ratio is 3. Find suitable diameter of the shat taking the allowable tensile and shear stresses as 100 MPa and 60 MPa. (16 Marks)

OR

6 a Design a cotter joint to connect two round rods and to sustain an axial load of 120 kN. The allowable stresses are 100 MPa in tension, 70 MPa in shear and 150 MPa in crushing. (10 Marks)

b Design a solid flange coupling of marine type to transmit 8.4kW at 400 rpm. The allowable shear stress for the shaft and bolts may be taken as 60 MPa and allowable crushing stress for key may be taken as 110 MPa. (6 Marks)

MODULE – IV

7 a Design a double riveted double cover butt joint to connect two plates of 20 mm thick. The allowable stresses are 90 MPa in tension, 60 MPa in shear and 150 MPa in crushing. (8 Marks)

b Find the suitable diameter for the riveted joint loaded as shown in fig Q7(b). The allowable stresses are 90 MPa in tension, 60 MPa in shear and 150 MPa in crushing.
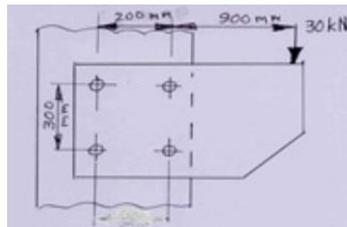

Fig Q 7(b)

(8 marks)

OR

8 a What are the advantages of welded joints over riveted joints? (6 Marks)

b Find the size of the weld for a joint loaded as shown in fig 8 (b). The allowable stress in the weld may be taken as 75 MPa. (10 Marks)
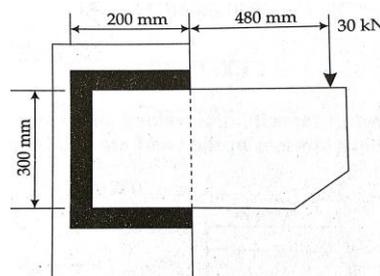

Fig Q 8(b)

MODULE – V

9 a A M20 x 2 steel bolt of length 100 mm is subjected to an impact load. The energy absorbed by bolt is 2 N-m. Find the stress in the bolt if the entire length of bolt is threaded. (06 Marks)

b The cylinder head of a steam engine is subjected to a steam pressure of 0.9 MPa. It is held in position by means of 6 bolts. The diameter of the cylinder is 420 mm. The allowable stress in the bolt is 90 MPa. Find the diameter of the bolt for the following cases: (10 Marks)

(i) Metal to metal joint.

(ii) A soft copper gasket is used to make the joint leak proof.

OR

10 a Derive the expression for efficiency of a square threaded power screw. (06 Marks)

b A trapezoidal threaded screw 40 mm diameter and 7 mm pitch, propels a load of 12 kN at a speed of 1.4 m / min. The end of screw is mounted on a thrust collar of 30 mm inside diameter and 60 mm outside diameter. The coefficient of thread friction is 0.12 and for collar is 0.15. Find (10 Marks)

(i) The power of motor required to drive the screw and

(ii) The efficiency of the screw.