PVP 14

Code: ME5T5

III B.Tech - I Semester – Regular Examinations – December 2016

DESIGN OF MACHINE MEMBERS-I
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: Use of approved designed data books is permitted

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) What are preferred numbers? Mention their significance.
b) What is the advantage of using the theories of elastic failure?
c) Determine the size of the bolt if two plates placed one over the other are joined by a bolt under the shear load of 5kN. Take the tensile yield stress for bolt material is 400 N/mm^2.
d) Distinguish the terms fatigue strength and endurance limit.
e) Define fatigue stress concentration factor.
f) Write down the expression for strength of parallel fillet weld in terms of permissible shear stress, leg of weld and length of welded joint.
g) Draw a double riveted single strap butt joint with zig-zag riveting.

h) What are the different types of stresses to which a bolt is subjected?

i) Where do you use knuckle joints and give practical applications?

j) Sketch the distribution of shear stresses in the wire of helical spring.

k) What is nipping of a leaf spring?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Explain the procedure of machine design. 6 M

   b) A shaft is designed based on maximum distortion energy theory with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310 MPa. It is subjected to an axial load of 40 kN. Determine the maximum torque capacity. Diameter of shaft is 20 mm . 10 M

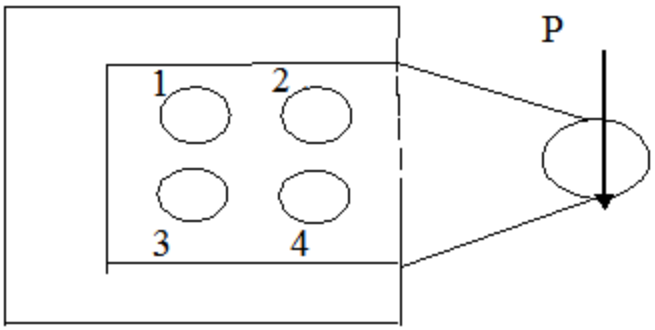
3. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress

concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. 16 M

4. a) Two plates 16 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 90 mm. The rivets are 25 mm in diameter. The permissible stresses are 140 MPa in tension, 80 MPa in shear and 160 MPa in crushing. Find the efficiency of the joint. 8 M

b) A 200X150X10 mm angle is joined to a frame by two parallel fillet welds along the edge of 200 mm length. If the angle is subjected to a static load of 200 kN, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa. 8 M

5. The structural connection shown in figure is subjected to an eccentric force P of 10 kN with an eccentricity of 500 mm from the C.G. of the bolts. The centre distance between bolts 1 and 2 is 200 mm, and the centre distance between the bolts 1 and 3 is 150 mm. All the bolts are identical. The bolts are made from plain carbon steel 30C8 (S_{yt} = 400 N/mm^2) and the factor of safety is 2.5. Determine the size of the bolts. 16 M



6. A safety valve, 50 mm in diameter, is to blow off at a pressure of 1.5 MPa. It is held on its seat by means of a helical compression spring, with an initial compression of 25mm. The maximum lift of the valve is 10mm. The spring index can be taken as 6. The spring is made of patented and cold drawn steel wire with ultimate tensile strength of 1500 N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire should be taken as 30% of the ultimate tensile strength. Design spring and calculate: (i) Wire diameter (ii) mean coil diameter (iii) number of active turns (iv) total number of turns (v) solid length (vi) free length and (vii) pitch of the coil.

16 M