



USN

--	--	--	--	--	--	--	--	--	--

CBCS SCHEME

:17ME54

Fifth Semester B.F. Degree Examination, Dec.2*9/,r4ii":1020

Design of Machine Elements

Time: 3 hrs.

Max. Marks: 100

Note:1. Answer FIVE full questions, choosing one full question from each module.
 2. Use of design data hand book permitted.

Module-1

1. a. With flow diagram, explain the phases of design. (05 Marks)
- b. List and explain the factors to be considered for selection of material for a machine component. (05 Marks)
- c. A point in a structural member is subjected to plane stress as shown in Fig. Q1 (c). Determine the following :
 - (i) Normal and tangential stress on a plane inclined at 45° .
 - (ii) Principal stresses and directions.
 - (iii) Maximum shear stress. (10 Marks)

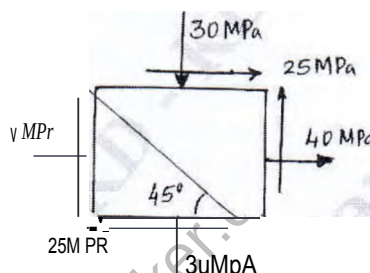


Fig. Q1 (c)

OR

2. a. What is stress concentration? Explain with neat sketches any three methods to reduce stress concentration in machine elements. (05 Marks)
- b. A round shaft made of Grey Cast Iron FG200 with a $\sigma_{ut} = 200$ MPa, is subjected to a bending moment of 15 N.m as shown in Fig. Q2 (b). The theoretical stress concentration factor at fillet is 1.5. Determine the diameter 'd' and max stress at the fillet. (05 Marks)

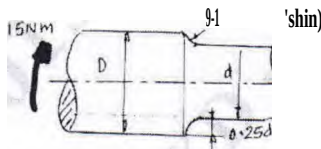


Fig. Q2 (b)

- c. A 50 mm steel rod supports a 9 kN load in addition to this a torsional moment of 100 N.m is applied on it as shown in Fig. Q2 (c). Determine the maximum tensile and maximum shear stresses. (10 Marks)

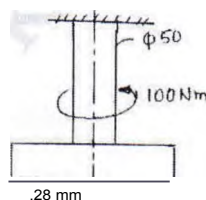


Fig. Q2 (c)

Module-2

3. a. Explain with sketches, the different types of varying stresses. (05 Marks)
- b. Derive Soderberg equation for designing members subjected to fatigue loading. (05 Marks)

(10 Marks)

(10 Marks)

(20 Marks)

(10 Marks)

SO::\ (10 Marks)

17ME54

- b. Determine the size of rivets required for the bracket shown in Fig. Q7 (b). Take permissible shear stress for the rivet material as 100 MPa. (10 Marks)

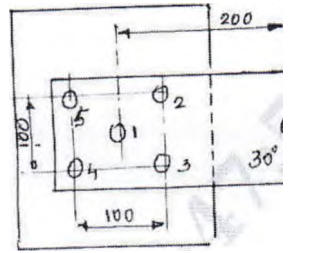


Fig. Q7 (b)

OR

- 8 a. The following Fig. Q8 (a) shows connections of eccentrically loaded welded joint. The allowable shear stress in the fillet weld using MS bar electrodes can be taken as 80 N/mm^2 , find the thickness of the plate. (10 Marks)

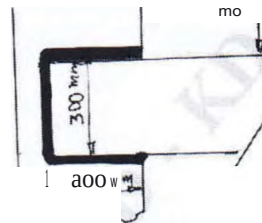


Fig. Q8 (a)

- b. A shaft of rectangular cross section is welded to a support by means of fillet welds as shown in Fig. Q8 (b). Determine the size of the weld if the permissible shear stress in the weld material is 75 MPa. (10 Marks)

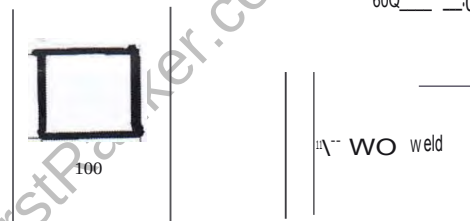
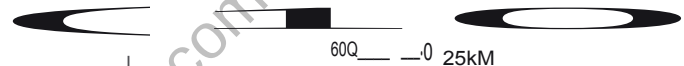


Fig. Q8 (b)

Module 5

- 9 a. A cylinder head is fastened to the cylinder of a compressor using 6 bolts of M20 size. Bolt material is C20 steel. The maximum fluid pressure is 3.5 MPa, cylinder diameter is 75 mm. A soft gasket is used. Assuming the initial tension required in each bolt is 40 kN, determine the factor of safety. (10 Marks)
- b. In a hand vice, the screw has double start Acme thread of 25 mm internal diameter and 4 mm pitch. If the length of the lever is 300 mm; the maximum force that can be applied at the end of the lever is 250 N. Determine the force with which the job is held between the jaws of the vice. Take co-efficient of friction at the thread is 0.14, angle of thread $20^\circ = 29'$. Neglect collar friction. (10 Marks)



OR

- 10 a. Explain self locking and overhauling. Derive an expression for torque required to lift the load on square threaded screw. (10 Marks)
- b. A single threaded power screw of 25 mm diameter with a pitch of 5 mm, a vertical load on the screw reaches a maximum load of 500 N. The co-efficients of friction are 0.05 for the collar and 0.08 for the screw. The frictional diameter of the collar is 30 mm. Find the torque required to rise and lower the load. Also find the efficiency of the power screw. (10 Marks)