CBCS SCHEME

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18AU53

Fifth Semester B.E. Degree Examination, June/July 2023
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Design Data hand book may be permitted.

Module-1

1 a. Explain the general design considerations in machine design. **(10 Marks)**

b. What are the factors should be consider for selection of factor of safety? **(10 Marks)**

OR

2 The load on a bold consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to,
(i) Maximum principal stress theory.
(ii) Maximum shear stress theory.
(iii) Distoration energy theory. **(20 Marks)**

Module-2

3 a. With neat sketches, explain the methods of reducing stress concentration in machine parts. **(10 Marks)**

b. Find the maximum stress induced in the following case taking stress concentration into account. A rectangular plate 60 mm×10 mm with a hole 12 mm diameter shown in Fig. Q3 (b) and subjected to a tensile load of 12 kN. **(10 Marks)**

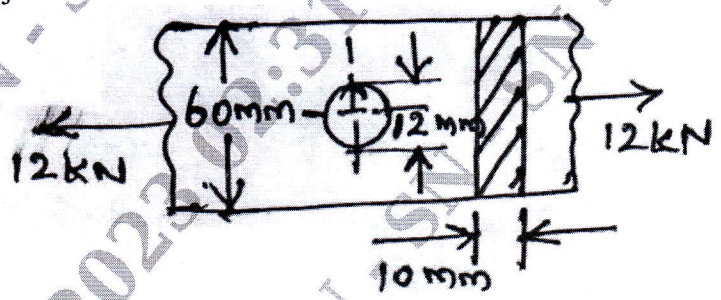

Fig. Q3 (b)

OR

4 a. Define the term Notch sensitivity and explain the same with examples. **(10 Marks)**

b. A machine components is subjected to a flexural stress which fluctuates between +300 MN/m^2 and −150 MN/m^2. Determine the value of minimum ultimate strength according to,
(i) Soderberg relation.
(ii) Goodman relation **(10 Marks)**

Module-3

5 Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. **(20 Marks)**

OR

6 A shaft is supported by two bearings placed in apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulley is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque an one pulley is equal to that on the other pulley. **(20 Marks)**

Module-4

7 a. Explain : (i) Caulking (ii) Fullering **(10 Marks)**

b. Find the efficiency of the following riveted joint :
Single riveted lap joint 6 mm plates
With 20 mm diameter rivets having a pitch of 50 mm. Assume :
Permissible tensile stress in plate = 120 MPa
Permissible shearing stress in rivets = 90 MPa
Permissible crushing stress in rivets = 180 MPa **(10 Marks)**

OR

8 a. With neat sketches, explain the types of welded joints. **(10 Marks)**

b. A welded joint as shown in Fig. Q8 (b), is subjected to an eccentric load of 2 kN. Find the size of weld, if the maximum shear stress in the weld is 25 MPa. **(10 Marks)**

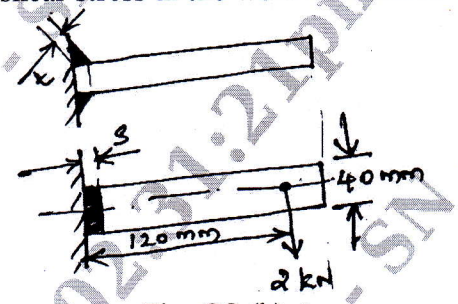

Fig. Q8 (b)

Module-5

9 a. Define the following terms used in screw threads :
(i) Pitch (ii) Crest (iii) Flank (iv) Lead (v) Root diameter **(10 Marks)**

b. A mild steel cover plate is to be designed for an inspection hole in the shell of a pressure vessel. The hole is 120 mm in diameter and the pressure inside the vessel is 6 N/mm^2. Design the cover plate along with the bolts. Assume allowable tensile stress for mild steel as 60 MPa and for bolt material as 40 MPa. **(10 Marks)**

OR

10 a. An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw thread is 0.1. Estimate power of the motor. **(10 Marks)**

b. Explain the types of screw threads used for power screws, with neat sketches. **(10 Marks)**

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