

BACHELOR OF MECHANICAL ENGINEERING EXAMINATION, 2017 (OLD)

(2nd Year, 2nd Semester)

MACHINE DESIGN - I

Time: Three Hours

Full Marks: 100

Missing data, if any, are to be reasonably chosen.

Give sketches wherever applicable.

Answer any **Four (04)** Questions

1. a) Design and draw a cotter joint for transmitting an axial load of ± 100 kN. Assume plain carbon steel (Yield strength in tension: 400 MPa, in shear 280 MPa, and in compression 500 MPa respectively) for all parts .
b) Write short note on the selection of suitable factor of safety in design. (20+05)

2. a) Discuss the importance of theories of failures in design. b) Discuss one failure theory suitable for brittle material. c) Discuss the modes of failures of machine components. d) Show that the efficiency of the self-locking screw is less than 50%. (03+04+03+05)

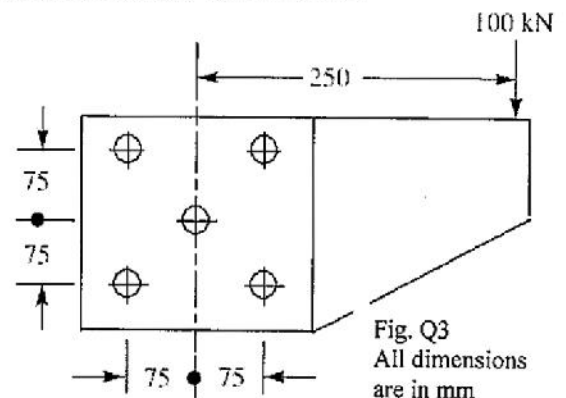
- e) Design a shaft as per A.S.M.E code based on the following data: (10)

- i) Torque and bending moments applied are 500 N-m and 200 N-m respectively. ii) The load is applied with light shock. iii) The shaft material is steel having ultimate strength 530 N/mm^2 , yield strength of 320 N/mm^2 .

3. a) Define nominal diameter, pitch diameter, lead and pitch of a screw thread. b) How do we designate ISO Metric thread? c) Discuss the different stresses developed in the threads due to initial tightening. (04+02+05)

- d) A bracket is fixed to the wall by means of 5 identical bolts as shown in Fig. Q3. Find out the nominal diameter of the bolts considering permissible shear stress as 70 MPa. (10)

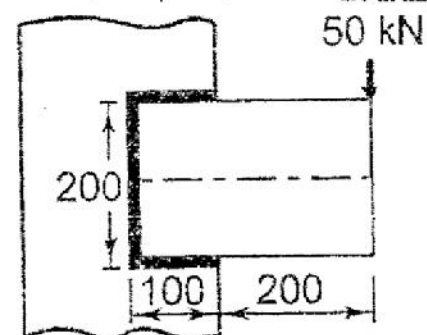
- e) Discuss the designation procedures of different steels. (04)



4. a) Discuss hot and cold riveting operations. b) A double riveted

double strap butt joint is used to connect two plates; each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear and compression are 90, 70 and 110 MPa respectively. Determine the efficiency of the joint. (03+09)

- c) Describe how a tensile test curve is useful to designers. d) Explain the role of stress concentration factor and notch sensitivity in design. e) How hardness and tensile strength are influenced by percentage of carbon present in steel? (04+05+04)



5. (a) A transmission shaft carries a pulley midway between the two bearings. The bending moment at the pulley varies from 200 N-m to -400 N-m, as the torsional moment in the shaft varies from 300 N-m to 600 N-m. The frequencies of bending and torsional moments are equal to the shaft speed. Ultimate and yield point stress are 580 and 430 N/mm^2 respectively. The corrected endurance limit stress is 215 N/mm^2 . Considering factor of safety as 2, find the diameter of the shaft using Soderberg line and Goodman line. (15)

- b) A welded connection of steel plates is shown in Fig. Q5. It is subjected to an eccentric load of 50kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 MPa. (10)