

B. E MECHANICAL ENGINEERING SECOND YEAR SECOND SEMESTER EXAM, 2018 (OLD)**MACHINE DESIGN -I**

Time: Three Hours

Full Marks: 100

Missing data, if any, are to be reasonably chosen. Give sketches wherever applicable.

Answer Question No 1 and any Five (05) Questions from the rest

1. Answer any 06 (six)

05x6=30

a) Discuss the significance of failure theories in design. b) Show that the efficiency of the self-locking screw is less than 50%. c) Discuss the failures of riveted joint. d) Discuss fundamental design considerations. e) Explain the role of stress concentration factor and notch sensitivity in design. f) Discuss the designation procedures of different steels. g) Discuss different stresses developed in the threads due to initial tightening.

2. Design rod, socket and spigot of a cotter joint for transmitting an axial load of ± 120 kN. Assume plain carbon steel (Yield strength in tension: 400 MPa, in shear 280 MPa, and in compression 500 MPa respectively) for all parts.

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3. A steel shaft of 600 mm length is simply supported at its end. It is subjected to a concentrated cyclic load at the mid that varies from 20 to 40 kN. Determine the diameter of the shaft by taking a factor of safety of 2, size factor of 0.8, surface finish factor of 0.9, fatigue stress concentration factor of 1.5. The material properties are: ultimate strength = 600 MPa, yield strength = 350 MPa.

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4. a) What is Miner's equation? b) A machine component made of steel is subjected to a reversed bending stress of 280 MPa for 25% of the time, a reversed bending stress of 350 MPa for 35% of the time, and a reversed bending stress of 450 MPa for 40% of the time. Determine the expected life of the component using the following: $\sigma_{yt} = 500$ N/mm², $\sigma_{ul} = 700$ N/mm², corrected endurance limit: 240 MPa.

04+10

5. a) A bracket is fixed to the wall by means of 5 identical bolts as shown in Fig. Q5. Find out the nominal diameter of the bolts considering permissible shear stress as 70 MPa. b) How do we calculate the efficiency of a riveted joint?

(12+02)

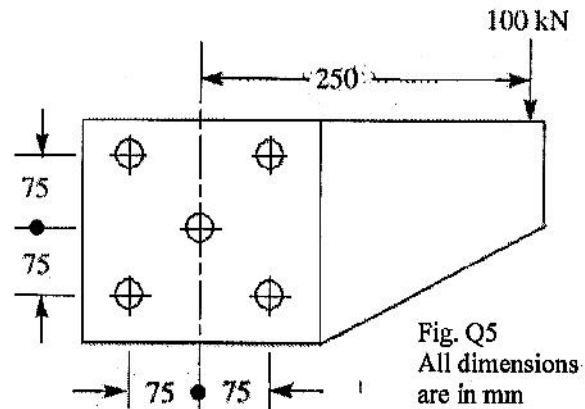


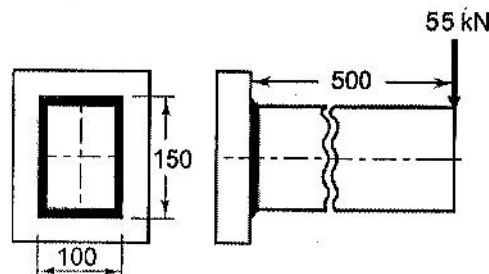
Fig. Q5
All dimensions are in mm

6. Calculate the diameter of the shaft based on maximum principal stress theory, maximum shear stress theory and distortion energy theory considering the following data: i) Rated power is 50 kW at 750 rpm, ii) The shaft is also subjected to a bending moment of 150 N-m., iii) The shaft material is plain carbon steel having ultimate strength 480 N/mm², yield strength of 310 N/mm², iv) Factor of safety is 2.0.

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7. A beam of rectangular cross-section is welded to a support by means of fillet welds as shown in Fig. Q7. Determine the size of the welds, if the permissible shear stress in the weld is limited to 100 MPa.

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All dimensions are in mm

Fig. Q7