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10AU52

Fifth Semester B.E. Degree Examination, June/July 2018

Design of Machines Elements – I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of data book is permitted.***

PART – A

1 a. Explain briefly the six steps involved in the design procedure. **(05 Marks)**

b. Draw stress-strain diagram for a ductile material subjected to tension. Explain the significance of salient points. **(05 Marks)**

c. A circular rod of 60 mm diameter is subjected to bending load and torsional load of shown in Fig.Q1(c). Determine the nature and magnitude of stresses at the critical points.

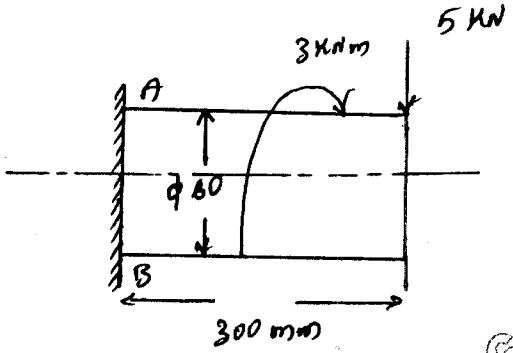

Fig.Q1(c) **(10 Marks)**

2 a. Explain stress concentration. Describe the methods adopted to reduce the effect of stress concentration. **(06 Marks)**

b. Explain the following theories of failure:
i) Maximum principal stress theory
ii) Maximum shear stress theory
iii) Distortion energy theory **(06 Marks)**

c. A cantilever beam of width 50 mm, depth 150 mm is 1.5 m long. It is struck by a weight of 1000 N that falls from a height of 10 mm at its free end. Determine:
i) Impact factor
ii) Instantaneous maximum deflection
iii) Instantaneous maximum stress
iv) Instantaneous maximum load.
Take $E = 20.6 \times 10^4$ N/mm^2. **(08 Marks)**

3 a. Derive the Soderberg relationship. **(05 Marks)**

b. Derive endurance limit. List the factors affecting endurance limit. **(05 Marks)**

c. A piston rod is subjected to a maximum reversed axial load of 110 kN. It is made of steel having an ultimate stress of 900 N/mm^2 and the surface is machined. The average endurance limit is 50% of the ultimate strength. Take the size correction coefficient as 0.85 and factor of safety = 1.75. Determine the diameter of the rod. **(10 Marks)**

4 a. Design a socket and spigot type cotter joint to sustain an axial load of 100 kN. The material selected for the joint has the following design stresses σ_t = 100 N/mm^2, σ_c = 150 N/mm and τ = 60 N/mm^2. **(14 Marks)**

b. A 20 kN power at 500 rpm is transmitted from 30 mm diameter shaft by means of Kennedy keys of 8 × 8 mm cross-section. Determine the required length of the keys, if the yield stress in tension of the key material is 360 N/mm^2 and factor of safety is 3. **(06 Marks)**

PART – B

5 A solid steel shaft running at 600 rpm is supported on bearings 600 mm apart. The shaft receives 40 KW through at 400 mm diameter pulley weighing 400 N located 300 mm to the right of left bearing by a vertical flat belt drive. The power is transmitted from the shaft through another pulley of diameter 600 mm weighing 600 N located 200 mm to the right of right bearing. The belt drives are at right angles to each other and ratio of belt tension is 3. Determine the size of shaft necessary. If the allowable shear stress in the shaft material is 40 MPa and the loads are steady. **(20 Marks)**

6 a. Explain various types of stresses in threaded fastening. **(06 Marks)**

b. Suggest the suitable size of bolts if the bracket shown in Fig.Q6(b) is subjected to a load of 20 kN at 60° from the vertical. The allowable tensile stress in the bolt is 120 MPa. The bracket is fixed using 4 bolts.

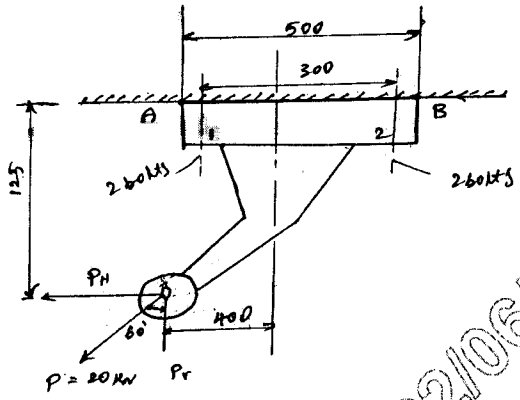

Fig.Q6(b) **(14 Marks)**

7 a. Briefly explain the failure of riveted joints. **(06 Marks)**

b. Design a double riveted butt joint to connect two plates 20 mm thick. The joint is zig-zag riveted and has equal width cover plates. The allowable tensile stress for the plate is 100 MPa. The allowable shear and crushing stresses for rivet material are 60 MPa and 120 MPa respectively. Calculate the efficiency of the joint. The joint should be load proof. **(14 Marks)**

8 a. A solid circular shaft 25 mm in diameter is welded to a support by means of a rivet weld as shown in Fig.Q8(a). Determine the lag dimensions of the weld if the permissible shear stress is 95 N/mm^2.

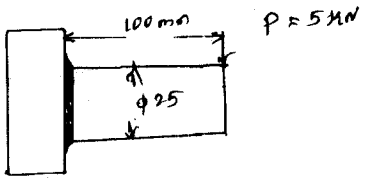

Fig.Q8(a) **(10 Marks)**

b. Explain self locking and overhauling in power screws and show that efficiency of self locking screw is less than fifty percentages. **(10 Marks)**

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