Total No. of Questions : 8]

SEAT No. :

PE2634

[Total No. of Pages : 4

[6583]-166

T.E. (Mechanical) (Mechanical Sandwich Engg.)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - V) (302043)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Derive expression for torque required to raise the load with suitable sketch. **[6]**

b) A 26×5 square threaded, single start power screw is used to support a load of 12 KN. The effective diameter to the collar is 46 mm and the coefficient of friction is 0.15. The nut is made of phosphor bronze having 0.12 as coefficient of friction and 6 MPa as allowable bearing pressure. The length of handle is 300 mm. Calculate: **[12]**

i) The force required to raise the load;

ii) The force required to lower the load;

iii) The yield strength of material for a factor of safety of 4;

iv) The overall efficiency of the screw and

v) The number of threads in nut.

OR

Q2) a) Explain with neat sketch recirculating ball screw and state it's application. **[6]**

b) The load screw of a lathe has a single start I.S.O metric trapezoidal threads of 52 mm nominal diameter and 8 mm pitch. The screw is required to expert on axial force of 2 KN in order to drive the tool carriage during the turning operation. The thrust is carried on collar of 100 mm outer diameter and 60 mm inner diameter. The value of coefficient of friction at the screw threads and collars are 0.15 and 0.12 respectively. If the load screw rotates at 30 r.p.m Calculate: **[12]**

i) The power required to drive the lead screw.

ii) The efficiency of screw.

Evaluate the result using Uniform wear theory.

P.T.O.

Q3) a) Explain with neat sketch the Gerber curve, Soderberg and Goodman lines? **[5]**

b) The work cycle of mechanical component subjected to completely reversed bending stresses consist of following three elements. **[12]**

i) ± 350 N/mm^2 for 85 % of time.

ii) ± 500 N/mm^2 for 3 % of time.

iii) ± 400 N/mm^2 for remaining time.

The component is made of plain carbon steel 50C4 (Sut = 660 N/mm^2). If endurance limit of component is 280 N/mm^2 , determine its life.

OR

Q4) a) What is stress concentration? State various causes of stress concentration? Explain any two methods to reduce it. **[5]**

b) A cantilever beam made of cold drawn steel 20C8 (Sut = 540 N/mm^2) is subjected to a completely reversed load of 1000 N as shown in Fig1. The notch sensitivity factor q at the fillet can be taken as 0.85 and the expected reliability is 90%. Determine the diameter d of the beam for a life of 10000 cycles. Assume surface finish, size and reliability factors are 0.78,0.85 and 0.897 respectively. Also assume K_t = 1.35. **[12]**

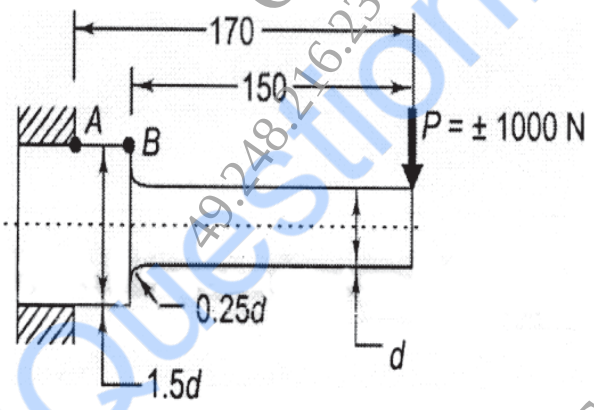

Fig1.

Q5) a) Write a note on bolt of uniform strength and explain the methods for achieving bolts of uniform strength. **[5]**

b) A steel plate subjected to a force of 5 kN and fixed to a channel by means of three identical bolts is shown in Fig2.The bolts are made from plain carbon steel 45C8 (S_{yt} = 380 N/mm^2) and the factor of safety is 3. Specify the size of bolts. **[12]**

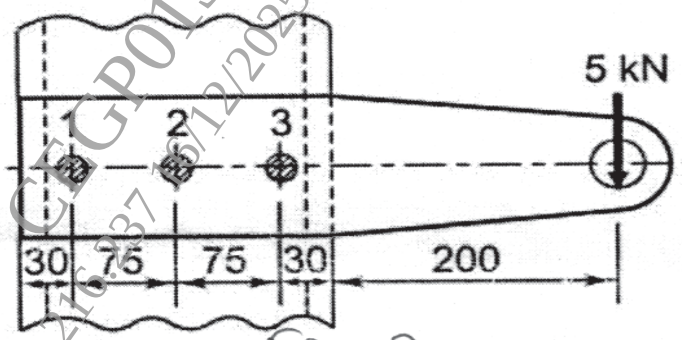

Fig. 2

OR

Q6) a) Explain the design procedure for the welded joint subjected to the Bending Moment. **[5]**

b) A steel plate, 100mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig3.The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 70 and 50 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume the tensile force acting on the plates as static. **[12]**

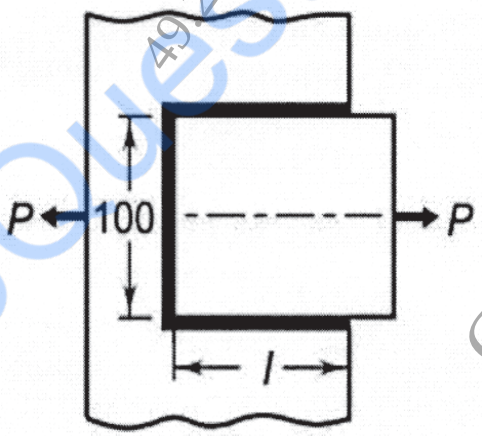

Fig. 3

Q7) a) Explain the following terms related to the Helical compression spring along with the equations required to calculate it. **[6]**

i) Solid Length
ii) Compressed length
iii) Free Length

b) A helical compression spring, made of circular wire, is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. Over this range of force, the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1050 N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate **[12]**

i) Wire diameter;
ii) Mean coil diameter;
iii) Number of active coils;
iv) Total number of coils;
v) Solid length of the spring;
vi) Free length of the spring;

OR

Q8) a) Explain Nipping of Leaf springs. **[6]**

b) It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 and 81 370 N/mm^2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: **[12]**

i) Wire diameter;
ii) Mean coil diameter;
iii) Number of active coils;
iv) Total number of coils;
v) Free length of the spring; and
vi) Pitch of the coil. Draw a neat sketch of the spring showing various dimensions.

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