17610

11819

4 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Answer ***each*** *next main question on a* ***new*** *page.*
(3) Illustrate your answers with neat sketches ***wherever*** *necessary.*
(4) Figures to the ***right*** *indicate* ***full*** *marks.*
(5) Assume suitable data, if ***necessary****.*
(6) Use of Non-programmable Electronic Pocket Calculator is ***permissible****.*
(7) Mobile Phone, Pager and any other Electronic Communication devices are ***not permissible*** *in Examination Hall.*

Marks

1. a) Attempt **any three** : **12**

i) State maximum principal shear stress theory and maximum shear stress theory.

ii) Define lever w.r. to (i) M.A. = 1 (ii) M.A. < 1 (iii) M.A. > 1. Define leverage.

iii) What is endurance limit ? Define fatigue failure.

iv) Explain :

i) Transverse shear stress

ii) Torsional shear stress with neat sketch.

b) Attempt **any one** : **6**

i) Define stress concentration with neat sketch. Explain with figures only the several ways of reducing the stress concentration in shafts and other cylindrical members with shoulders, holes and threads respectively.

ii) Design a shaft transmitting power of 60 KW at 600 rpm as shown in Fig. No. 1. The shaft is hollow having ratio of inner to outer diameter 0.5. The shaft carries pulley 'C' as shown. The angle of contact between belt and pulley is 180°. The belts are vertical as shown. The diameter and weight of pulley are 250 mm and 700 N respectively and the ratio of tight-side to slam side tension is 3. Take $K_m = 2$, $K_t = 1.5$. Design shaft if shear stress in material is not to exceed 52 N/mm^2.

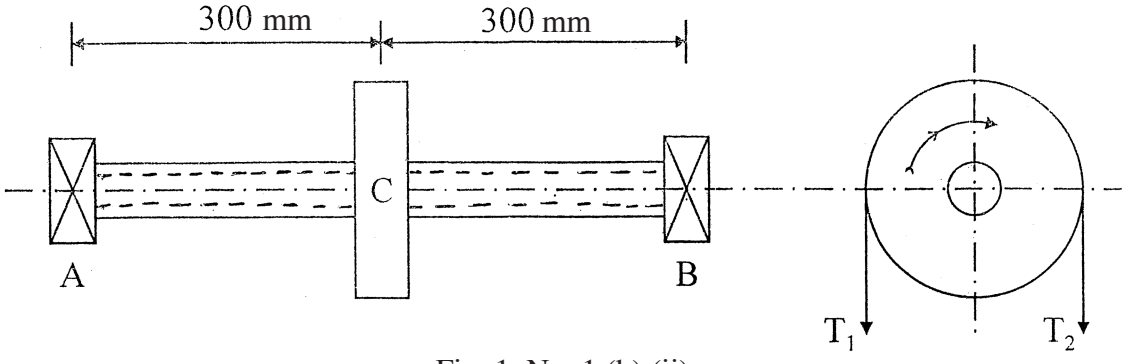


Fig. 1. No. 1 (b) (ii)

P.T.O.

Marks

2. Attempt **any two** : **16**

a) Write down the design procedure of power screw for nut and screw with diagram.

b) Explain design procedure of a flange coupling.

c) i) Define factor of safety for brittle material and ductile material. **4**

ii) Design a rectangle key for shaft of 50 mm diameter. The permissible stresses for key material are 40 N/mm^2 in shear and 70 N/mm^2 in crushing. **4**

3. Attempt **any four** : **16**

a) What is the effect of keyways on strength of shaft. Write the expression.

b) Write advantages and disadvantages of square thread over 'V' threads (two each).

c) Suggest suitable material for the following machine parts (i) Crank shaft (ii) Helical spring (iii) Bushes for Knuckle pin (iv) Lathe bed.

d) Suggest suitable couplings in the following cases :

i) Shaft having perfect alignment

ii) Shaft having both lateral and angular misalignment.

e) Explain the gear tooth failure modes :

i) Scoring ii) Pitting.

4. a) Attempt **any three** : **12**

i) Define the terms :

i) Solid length

ii) Spring index

iii) Free length

iv) Spring rate, w.r. to helical compression spring.

ii) Write any four ergonomic considerations which makes the job comfortable.

iii) Draw the graph of Wahl's stress factor Vs spring index for helical compression spring and state the effect of curvature of the coil on the stress distribution.

iv) Write only the equations for the conditions :

i) Self-locking

ii) Overhauling of a power screw and explain the terms used.

b) Attempt **any one** : **6**

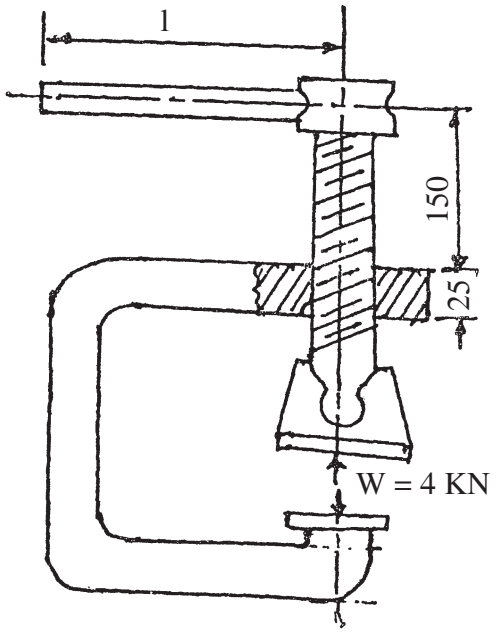
i) State the strength equations for double parallel fillet weld and double transverse fillet weld with sketches.

Marks

ii) The C-clamp as shown in Fig. No. 2, has trapezoidal threads of 12 mm outside diameter and 2 mm pitch. The coefficient of friction for screw thread is 0.15 and for the collar is 0.28. The mean radius of the collar is 8 mm. If the force exerted by the operator at the end of handle is 80 N. Find :

i) The length of handle

ii) The bearing pressure on the threads.



All dimensions in mm

Fig. No. 2/No. 4 (b) (ii)

5. Attempt **any two** : **16**

a) A Knuckle joint is required to withstand a tensile load of 25 KN. Design the joint if, the permissible stresses are $f_t = 56$ N/mm^2, $f_s = 40$ N/mm^2, $f_c = 70$ N/mm^2.

b) i) Define the following terms related to bearing

a) Bearing modulus

b) Critical pressure

ii) State any four advantages and disadvantages of welded joint over screwed joint.

c) Design a helical compression spring for a maximum load of 1200 N and deflection 30 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 KN/mm^2

Take Wahl's stress factor

$$K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$$

Where C = spring index

Marks

6. Attempt **any four** : **16**

a) Write Lewis equation for strength of a gear tooth with usual notations.

b) A wall bracket as shown in Fig. No. 3 is fixed to a wall by means of four bolts. Find the size of the bolts. The safe stress in tension for the bolt may be assumed as 70 N/mm^2.

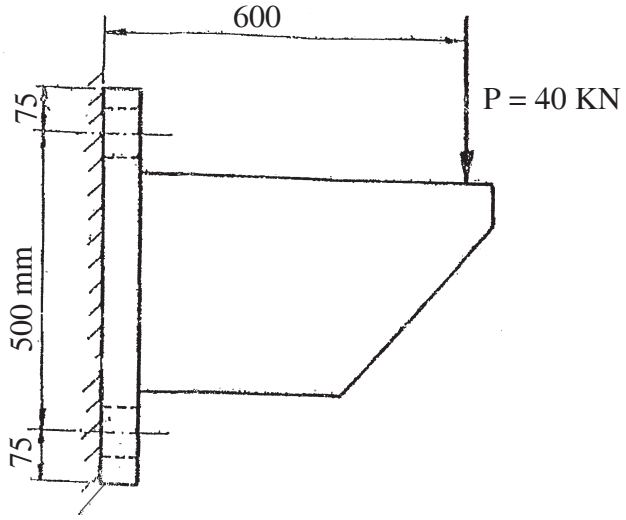


Fig. No. 3/No. 6 (b)

c) Compare sliding contact bearing and roller contact bearing on the basis of size, life, coefficient of friction and housing diameter.

d) Explain the methods of obtaining bolts of uniform strength.

e) Write down procedure for selection of bearing from manufacturer's catalogue.