

QP Code : 1900

(Old course)

Max. Marks : 100

Duration : 4 hours

- Instructions:* 1) Question No. 1 is compulsory.
2) Answer any **four** from the remaining six questions.
3) Use of recommended **Design data book** is permitted.
4) Use your judgment for unspecified data, if any.

Q.1 Solve any **four** of the followings:

(4x5 =20)

- a) What do you understand by following designations of materials:
i) FG350 ii) CS1030 iii) 40C8 FeE400 iv) 40Cr1Mo28
v) 40C8
- b) What is service factor ? state its significance.
- c) 'Curved beams cannot be designed by applying the simple bending theory of straight beams'. Justify the statement.
- d) What are the advantages of hollow shaft over solid shaft ? State any two examples where hollow shafts are used.
- e) 'Square key is stronger against crushing than rectangular key'. Justify the statement.
- f) State the advantages and limitations of belt drives.

Q.2 a) What is cotter ? Why a taper is provided on a cotter ? state the applications of cotter joint. (5)

b) A Knuckle joint is subjected to an axial load of 80 kN. Determine the diameter of knuckle pin considering the load to be uniformly distributed over the pin in the eye and uniformly varying over the portion of pin in forks. Use the following data:

- i) Allowable tensile and compressive stress for pin = 600 N/mm^2
ii) Allowable shear stress for pin = 300 N/mm^2
iii) Allowable bearing pressure for pin = 200 N/mm^2
iv) Thickness of eye = $1.5 \times$ pin diameter
v) Total fork thickness = eye thickness

Draw a neat sketch of the joint. (15)

Q.3 a) Machine press screw as shown in figure 1 is subjected to an axial force of 45 kN.

Overhang of horizontal member of frame is 420 mm and height of screw is 510 mm. (13)

- i) Select the suitable material and stresses for screw, nut and frame.
ii) Design screw and nut,
iii) Check the screw for buckling failure.
iv) Determine the dimensions of cross-section of horizontal member of frame.

QP-Con. 8449-15.

P.T.O

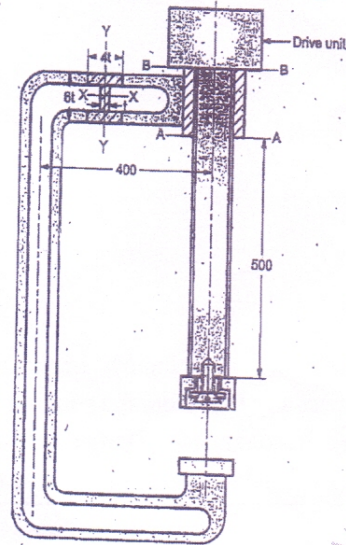


Figure 1

- b) A steel plate subjected to a force of 6 kN and fixed to a channel by means of three identical bolts, as shown in figure 2. The bolts are made from plain carbon steel 45C8 and factor of safety is 3. Specify the size of bolts. (7)

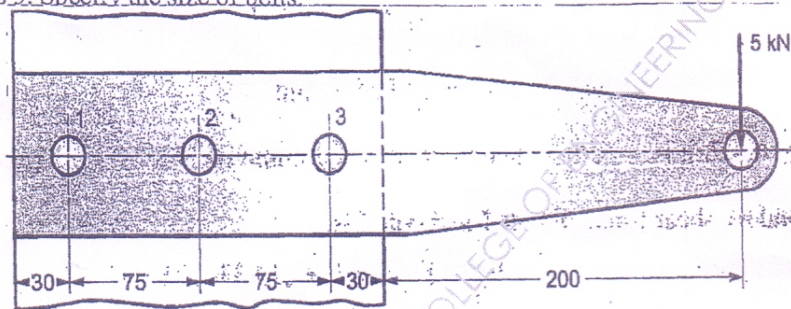


Figure 2

- Q.4 a) The mechanical component is subjected to the following bending stress cycles:

- i) $\pm 350 \text{ N/mm}^2$ for 70 % of time;
- ii) $\pm 500 \text{ N/mm}^2$ for 5 % of time.
- iv) $\pm 300 \text{ N/mm}^2$ for remaining time.

The component is made of plain carbon steel 50C4 ($S_{ut} = 660 \text{ N/mm}^2$). If the endurance limit of the component is 280 N/mm^2 , determine its life. (12)

- b) How will you find the endurance limit of the material experimentally? Explain. (8)

- Q.5 a) Compare the weight of equal length of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both shafts is same and inside diameter is $2/3$ of outside diameter for hollow shaft. (8)

- b) A bushed-pin type flexible flange coupling is used to transmit 30 kW power at 1440 rpm from an electric motor to a machine. If the peak torque is 20 % more than the average torque, design the coupling. Assuming suitable materials and permissible stresses for the components of coupling. Take permissible bearing pressure = 1 N/mm^2 (12)

Q.6 a) A helical compression spring is to be designed for a maximum load of 8 kN with a corresponding deflection of 85 mm. Determine:

- i) the wire diameter; ii) the number of active turns ; iii) free length; iv) pitch length ;
v) helix angle.

For the spring material, assume: $S_{ut} = \frac{2000}{d^{0.168}}, N/mm^2$;

$$S_{ys} = \frac{1200}{d^{0.168}}, N/mm^2 ; G = 8 \times 10^4 N/mm^2$$

Assume average service

(10)

b) A leaf spring has 12 number of leaves, two of which are extra full length. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is 5.4 kN, with permissible stress of $280 N/mm^2$. The ratio of total depth of the width is 3. Determine:

- i) the thickness and width of leaves ; and ii) the deflection of spring. (10)

Q.7 a) A flat belt drive is to be used to drive a reciprocating compressor running at 720 rpm. by a 15 kW, 1440 r.p.m., electric motor. The required centre distance is 2 m. Select the flat belt for the drive. From the manufacturer's catalogue, the power rating per mm width of the belt per ply at 180° arc of contact and 10 m/s belt speed is 0.023 kW. (15)

- b) Explain the effect of polygonal action on the performance of chain. (5)

Course: T. E. (SEM.-VI) (REV-2007) (MECH ENGG.) C.W. (AUTO. ENGG.) (Prog-T3516 CW T2216)

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Correction:

Q. No. 1.

a)

v) Take 30C8 instead of 40C8

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Correction:

Q. No. 3.

b) Take force of 5 KN instead of 6 KN

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