Seat No. | | | | | | |

CBI1323

Machine Design - I (New)
(1020)

P. Pages : 4

Time : Four Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and attempt **any two** bits out of a, b, c from each question.
5. Draw neat sketches whenever necessary.
6. Use of PSG Design data book & non programmable calculator is allowed.
7. Assume suitable data if necessory.

UNIT - I

1. a) The load on O bolt consist of an axial pull of 10KN together with a transverse shear free 5KN. Find the diameter at bolt required according to -

i) Maximum principal stress theory.

ii) Maximum shear stress theory.

iii) Maximum principle strain energy theory. **10**

b) Design cotter joint to support a load varying from 20KN in tension to 30KN in compression. The following allowable stresses may be used for the material at the joint used. Tensile stress equal to compressive stress = 50MPa, Shear stress = 35MPa, Crushing stress = 90MPa. **10**

c) Write a short note on : **10**

i) Sources of Design data.

ii) Selection of preferred sizes.

UNIT - II

2. a) Design a shaft to transmit power from an electric motor to a lathe head stock thro. a pulley by means of a belt drive. The pulley weight 200N and is located at 300mm from the centre of bearing. The diameter of the pulley is 200mm and the maximum power transmitted is 1KW at 120 rpm. The angle of lap of the belt is 180° and coeff. at friction bet^n the belt and the pulley is 0.3. The stock & fatigue factory for bending and twisting are 1.5 and 2.0 respectively. **10**

b) A protected type rigid flange coupling is used to transmit 25KW power at 500rpm from an engine to a machine. Design a coupling for an overload capacity of 25% assume following permissible stresses for the component of coupling.

	C.I. (flange)	M.S. (shaft & key)	Plain carbon steel (Bolt)
Allowable tensile stree N/mm^2	20	60	60
Allowable shear stress N/mm^2	12	35	28
Allowable compressive stress N/mm^2	60	60	60

Assume no. of bolt as 6. **10**

c) Write a short note on : **10**
i) Design of splines
ii) Bush - pin type coupling.

UNIT - III

3. a) A 50mm diameter solid shaft is welded to a flat plate as shown in fig (a). If the size of weld is 15mm. Find the maximum normal and shear stress in the weld. **10**

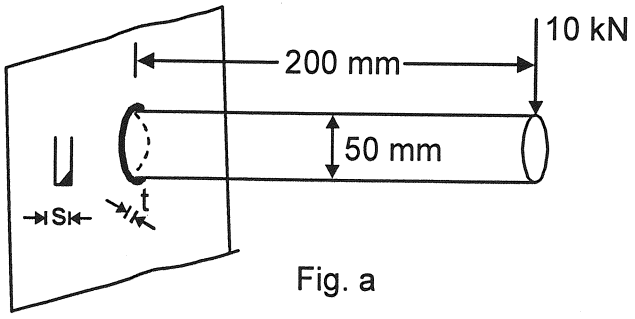

Fig. a

b) A bracket has to fixed to a wall using a bolt. The possible arrangement of fixing them are shown in fig. (b). Determine the size of bolts required in each case if the yield strength of bolt material is 410MPa.

Assume factor at safety 3

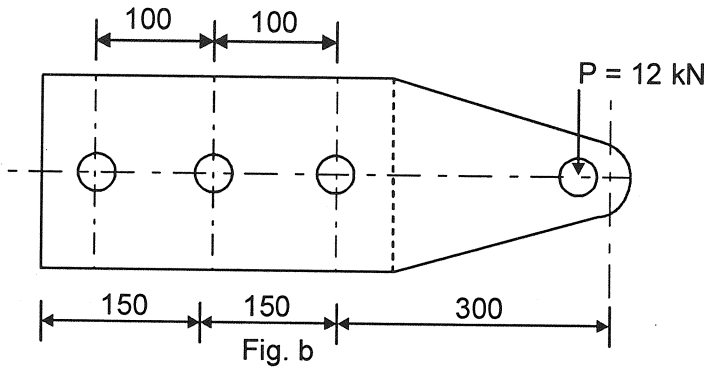

Fig. b

Size	Pitch (mm)	Stress Area
M 24	3	353
M 30	3.5	561
M 33	3.5	694
M 36	4	817

10

c) i) Explain I.S.O. metric screw threads. 5

ii) Prove that for circular fillet weld subjected to torsion $Z_{max} = \frac{2.829T}{\pi s d^2}$. 5

UNIT - IV

4. a) The mean diameter at the square thread screw having pitch at 10mm is 50mm. A load of 20KN is lifted through a distance at 170mm. Find the workdone in lifting the load and the efficiency of the screw when

i) The load rotates with screw and

ii) The load rest's on loose head which does rotate with screw.

The external and internal diameter at the bearing surface at the loose head are 60mm and 10mm respectively. The coeff. of friction for the screw and bearing surface may be taken as 0.08. 10

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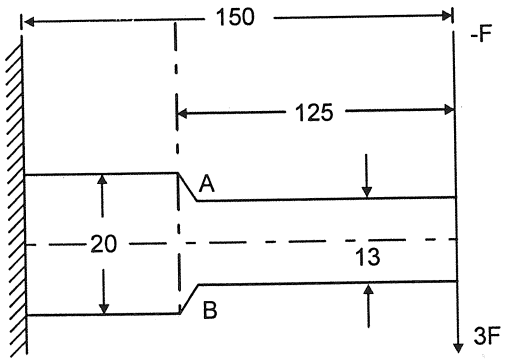
b) It is required to design a helical compression spring subjected to maximum force of 1250N. The deflection of spring corrousponding to maximum force, should be approx 30mm. The spring index can be taken as 6. The spring is made up of patented & cold drawn steel wire. The ultimate tensile strength & modulus of rigidity at the spring material are 1090 & 81370N/mm^2 respectively. The permissible shear stress for spring wire should be taken as 50% of ultimate strength.
Design the spring & calculate :
i) Wire Diameter, ii) Mean coil diameter, iii) No. of active coil,
iv) Total no. of coil, v) free length of spring, vi) pitch of the coil.
Draw a neat sketch at spring showing various dimension. **10**

c) Define the following terms :
i) free length, ii) Solid length, iii) Spring shiffness, iv) spring index,
v) Active & Inactive coils.

UNIT - V

5. a) Write short note on : **10**
i) Histogram & frequency polygon.
ii) Endurance limit - approximate estimate. **10**

b) A cantilever beam made of cold drawn carbon steel & circulator cross section as shown in fig. is subjected to a load which varies from - F to 3F. Determine the maximum load that this member can withstand for an idenfinite life using a factor of safety as 2. The theoretical stress concentration factor is 1.42 & notch sensitivity is 0.9. Assume the following values.
Ultimate stress = 550 MPa
Yield stress = 470 MPa
Endurance limit = 275 MPa
Size factor = 0.85
Surface finish factor = 0.89
F.O.S. = 2 **10**



c) Explain stress concentration and remedies to reduce stress concentration factor. **10**

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