



- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Assume suitable data whenever necessary.
 7. Illustrate your answers whenever necessary with the help of neat sketches.
 8. Use of non programmable calculator is permitted.
 9. Use of Design data book is permitted.

1. a) What is meant by the following term. 8
- i) Indentation hardness
 - ii) Fatigue
 - iii) Damping Capacity
 - iv) Isotropy
- b) Two mild steel rods are connected by a knuckle joint to transmit an axial load of 150 kN. 12
Design the joint completely. Select the working stresses for both pin and rod material as 80 N/mm^2 in tension 65 N/mm^2 in shear and 150 N/mm^2 in crushing.

OR

2. a) Design a socket type cotter joint for an axial load of 50 kN which alternately changes 10
from tensile to compressive. The allowable stresses in all parts are
tensile stress = 55 N/mm^2
bearing stress = 65 N/mm^2
shear stress = 40 N/mm^2
- b) A boiler is to be designed for a steam pressure of 1.7 N/mm^2 having the inside diameter 10
of drum 900 mm. Design the longitudinal joint. The allowable stresses are
tensile stress = 77 N/mm^2
shear stress = 60 N/mm^2
crushing stress = 135 N/mm^2
3. a) A plate 75 mm wide and 10 mm thick is joined with another plate by a single transverse 10
weld and double parallel fillet weld as shown in fig. 3 (a). The maximum allowable tensile
stress and shear stress are 75 N/mm^2 and 60 N/mm^2 respectively. Find the length of each
parallel fillet weld if the joint is subjected to both static and fatigue loading.

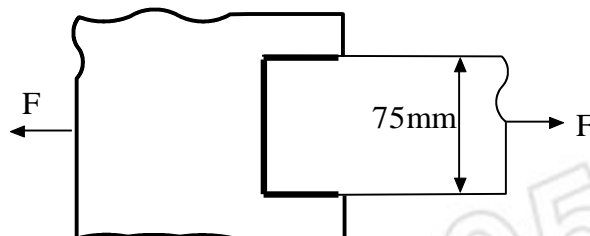
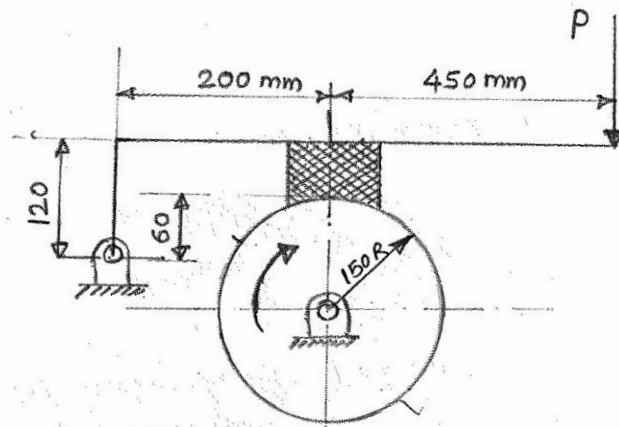


Fig : 3 (a)

- b) A hand lever of length 1000 mm from centre of shaft to point of application is subjected to load of 200 N. Calculate : **10**
- Diameter of solid shaft, allowable shear stress is 40 N/mm^2 .
 - What is twist of shaft per meter length.
 - Distance moved by the point of application of load due to elasticity.
 - Determine the section of lever near the boss, if the permissible bending stress is 72 N/mm^2 and Assume section of lever as rectangular near the boss $B = 3t$ $B \rightarrow$ width & $t \rightarrow$ thickness .
4. a) Enumerate the function of Gaskets alongwith their advantages. **4**
- b) A pressure vessel of 250 mm inner diameter is subjected to an internal pressure of 1 MPa. Pressure vessel is made of cost iron with allowable stress 35 MPa. The top cover plate is flat circular while bottom cover plate is hemispherical and integral welded. Determine : **16**
- Thickness of shell
 - Thickness of bottom cover plate
 - Size and number of bolt required for top cover plate.
 - Gasket for leak proof joint.
 - Thickness of top cover plate.
5. A solid shaft transmitting 20 kw at 400 RPM is supported on two bearings 900 mm apart. The shaft carry two gear of 20 degree pressure angle keyed to it. One of the gears having 32 teeth of 4 mm module is located 150 mm to the left of right hand bearing. This gear rotate, anticlockwise and delivers power horizontally to the right when view from left hand bearing. The other gear having 80 teeth of 3 mm module is located 150 mm to right of left hand bearing and receivers power in a vertical direction from below. The combined shock and fatigue factors for torsion and bending may be taken as 1.2 and 1.5 respectively. Design the shaft for strength criteria. Assume shaft material as SAE 1030. **20**
6. a) A railway Wagon weighing 18 kN and moving at velocity of 72 m/min, is brought to rest by a bumper consisting of two helical springs to square section. The mean diameter of coil is six times the side of square section. In bringing the wagon to rest the springs are to be compressed by 200 mm. The permissible shear stress is not to exceed 400 N/mm^2 select spring index of '6' and find **10**
- Maximum load on each spring.
 - Side of square section wire.
 - Mean diameter of the coils
 - Number of Active coil.
- Take $G = 84 \times 10^3 \text{ N/mm}^2$.
- b) Design a semi - elliptical laminated spring 1060 mm between centre of hooks held together at the centre by a 60 mm wide band and carrying a load of 6 kN. The allowable stress for spring material is 500 N/mm^2 . Calculate the number of leaves, width and thickness of leaves if the deflection is not to exceed 70 mm when **10**
- Leaves are unstressed initially
 - Leaves are stressed initally.

7. a) A single block brake with torque capacity of 15 N.m is shown in fig. 7 (a). The coefficient of friction is 0.3 and the maximum pressure on the brake lining is 1N/mm^2 . The width of block is equal to it's length. Calculate :
- The actuating force
 - The dimensions of block
 - The resultant hinge pin reaction.



All Dimensions ARE in mm

Fig. 7(a)

- b) A multiple disc clutch, steel on bronze is to transmit 4 kw at 800 RPM the inner radius of contact is 38 mm and the outer radius of contact is 72 mm. The clutch operates in oil with an expected coefficient of friction 0.10. The average pressure is 0.36N/mm^2 maximum. Determine.
- Total disc of steel and bronze required.
 - Axial force required.
8. a) What is function of Power Screw? Also discuss in brief the self locking of power screw. 5
- b) Design the screw drive of jack for load capacity of 100 kN. Lifting height is 0.5 meter. 15
- The maximum stress for screw lever are
 The ultimate stress in tension = 540 MPa
 Yield point stress in tension = 300 MPa
 Yield stress in shear = 190 MPa
 Take factor of safety = 2.25
- The maximum stress for nut are
 Yield stress in tension = 130 MPa
 Yield stress in compression = 120 MPa
 Yield stress in shear = 105 MPa
- The design should include
- Screw
 - Nut
 - Lever
