

Question Bank

Unit-1

1. Define concept of machine design & write classification of machine design.
2. What are general design procedure in machine design & explain it in detail
3. What are Considerations in machine design explain any five.
4. Write a note on ISO9000.
5. What are the Elements of ISO 9000 Quality Management System?
6. What are the ISO 9000 Principles?
7. What are the aspects of aesthetic design?
8. What are the ergonomics to be considered while design of display?

Unit-2

1. Explain following theories of failure
 - Maximum normal stress theory
 - Maximum shear stress theory
 - Maximum distortion energy theory
2. Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension ; 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint design.
3. Design a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing
4. The pull in the tie rod of a roof truss is 44 kN. Design a suitable adjustable screw joint. The permissible tensile and shear stresses are 75 MPa and 37.5 MPa respectively. Draw full size two suitable views of the joint

5. A knuckle joint is required to withstand a tensile load of 25 kN. Design the joint if the permissible stresses are :

$$\sigma_t = 56 \text{ MPa} ; q = 40 \text{ MPa and } \sigma_c = 70 \text{ MPa.}$$

6. Sketch two views of a knuckle joint and write the equations showing the strength of joint for the most probable modes of failure.

Unit-3

1. What is stress concentration? write remedies for stress concentration.
2. What is fatigue failure and Endurance stress?
3. Write a short note on fluctuating stress.
4. Draw and explain low cycle and high cycle fatigue diagram
5. Write design for finite and infinite life for reverse stress
6. Draw and explain soderberg and goodman diagram with line equation.
7. Draw and explain modified goodman diagram for both condition.

Unit- 4

- 1) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. **(Example 14.5. Khurmi)**
- 2) A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5 metre in diameter and has belt tensions 5.4 kN and 1.8 kN on the tight side and slack side of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the centre line of the bearing being 400 mm, find the diameter of the shaft. Assuming maximum allowable shear stress of 42 MPa. **(Example 14.8. Khurmi)**
- 3) A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. **(Example 14.9. Khurmi)**
- 4) With diagram explain unprotected type flange coupling.
- 5) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :
 - Shear stress for shaft, bolt and key material = 40 MPa
 - Crushing stress for bolt and key = 80 MPa
 - Shear stress for cast iron = 8 MPa**(Example 13.6 Khurmi)**

6) Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa

7) Design a rigid flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below:

Shear stress on shaft = 100 MPa

Bearing or crushing stress on shaft = 250 MPa

Shear stress on keys = 100 MPa

Bearing stress on keys = 250 MPa

Shearing stress on cast iron = 200 MPa

Shear stress on bolts = 100 MPa

(Example 13.9. Khurmi)

Unit- 5

1) Write Advantages and Disadvantages of Welded Joints over Riveted Joints (Page no 342)

2) Write Types of Screw Threads used for Power Screws (Page No 625)

3) A crane runway bracket is shown in Fig. 11.32. Determine the tensile and compressive stresses produced in the section X-X when the magnitude of the wheel load is 15 kN. Also find the maximum stress produced in the bolts used for fastening the bracket to the roof truss. **(Example 11.13 Khurmi)**

4) For supporting the travelling crane in a workshop, the brackets are fixed on steel columns as shown in Fig. 11.35. The maximum load that comes on the bracket is 12 kN acting vertically at a distance of 400 mm from the face of the column. The vertical face of the bracket is secured to a column by four bolts, in two rows (two in each row) at a distance of 50 mm from the lower edge of the bracket. Determine the size of the bolts if the permissible value of the tensile stress for the bolt material is 84 MPa. Also find the cross-section of the arm of the bracket which is rectangular. **(Example 11.14. Khurmi)**

5) A screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor-bronze for which the elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut

and the screw is not to exceed 18 N/mm^2 . Design and draw the screw jack. The design should include the design of 1. screw, 2. nut, 3. handle and cup, and 4. body. (**Example 17.15. Khurmi**)

Unit- 6

- 1) Write and explain types of spring with diagram. (Page no 820)
- 2) Write 5 terms used in Compression Springs (page no 925)
- 3) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2 , find the axial load which the spring can carry and the deflection per active turn. (**Example 23.2. Khurmi**)
- 4) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2 . Also calculate the maximum shear stress induced. (**Example 23.3. Khurmi**)
- 5) A mechanism used in printing machinery consists of a tension spring assembled with a preload of 30 N. The wire diameter of spring is 2 mm with a spring index of 6. The spring has 18 active coils. The spring wire is hard drawn and oil tempered having following material properties:
Design shear stress = 680 MPa

Modulus of rigidity = 80 kN/mm^2

Determine : 1. the initial torsional shear stress in the wire;

2. spring rate; and

3. the force to cause the body of the spring to its yield strength.

(Example 23.4. Khurmi)

6) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, $G = 84 \text{ kN/mm}^2$.

Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. **(Example 23.6. Khurmi)**