QUESTION FROM PREVIOUS YEARS PAPERS

STRESSES & STRAINS

Q1. Define

a. Compressive load
b. Strain
c. Volumetric strain.
d. Poisson's ratio
e. Proof stress
f. Working stress
g. Factor of safety
h. Young's modulus of elasticity
i. Modulus of rigidity

Q2. Explain the terms Ductility, Brittleness, Hardness and Toughness of material.

Q3. Explain briefly the mechanical properties of materials.

Q4. What are the temperature stresses and strains?

Q5. Draw stress-strain curve for mild steel & explain in short.

Q6. A circular steel bar of 20mm diameter carries a tensile load of 30KN.Find the tensile stress in the bar and the elongation in a length of 300mm.

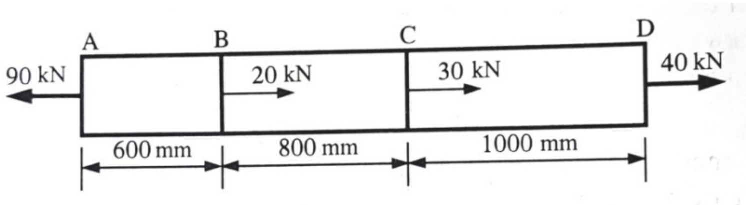
Q7. Find the minimum diameter of a steel wire which is used to raise a load of 5000 N if the stress in the wire is not to exceed 95 N/mm^2.

Q8. A string 4 mm in diameter has original length 2 m. The string is pulled by a force of 200 N. If the final length of the spring is 2.02 m, determine: i) stress ii) strain iii) Young's modulus

Q9. A bar of 20 mm in square cross-section is subjected to a tensile load of 10^5 N and the measured extension over a length of 200 mm was found to be 0.16mm. The contraction in the lateral dimension was 0.005 mm. Determine the modulus of rigidity.

Q10. A tube of aluminum 40mm external diameter and 20 mm internal diameter is snugly fitted on a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by an axial load P. Find the stress in aluminum tube when the load is such that the stress in steel rod is $70N/mm^2$. What is the value of P? $E_s=200GN/m^2$ and $E = 70GN/m^2$.

Q11. A brass bar, having cross sectional area of 1000 mm^2, subjected to axial forces as shown in figure below. Find the total elongation of bar. Take $E = 1X10^5$ N/mm^2.



THIN CYLINDRICAL SHELLS

Q1. Distinguish between Circumferential and Longitudinal stress in a thin cylindrical shell.

STRAIN ENERGY

Q1. What is meant by resilience and proof resilience?

Q2. Define strain energy, proof resilience & modulus of resilience.

Q3. Derive expression for the strain energy stored in a body when the load is applied gradually.

Q4. A steel specimen 1.5 cm^2 in cross-section stretches 0.05 mm over 5 cm gauge length under an axial load of 30 kN. Calculate the strain energy stored in the specimen at this point. If the load at the elastic limit for the specimen is 50 kN, calculate the elongation at the elastic limit and the resilience.

Q5. A load of 50 kN is suddenly applied to a steel rod 2m long and 1000 mm^2 in cross-section. Determine the strain energy that can be absorbed, if E=200 KN/mm^2.

MOMENT OF INERTIA

Q1. State the theorem of Perpendicular and Parallel axis.

Q2. Define moment of inertia, section modulus & radius of gyration.

Q3. A T-section is of 150 mm x150 mm x 50 mm. Determine Ixx, Iyy both passing through the centroid and the least value of section modulus about XX.

Q4. A T-section is of 100 mm x100 mm x 20 mm. Determine Ixx, Iyy both passing through the centroid and the least value of section modulus about XX.

Q5. Find the moment of Inertia of a T-Section 20 cm x15cm x5 cm about centroidal axis.

BENDING STRESSES

Q1. What do you understand by neutral axis and moment of resistance?

Q2. Write down the bending equation, and explain each term.

Q3. State the assumptions in the theory of simple bending.

Q4. Derive the bending equation

Q5. What is section modulus and explain relation between mass and the inertia.

Q6. A rectangular beam 300mm deep 150mm wide is simply supported over a span of 8m. Find the maximum uniformly distributed load that the beam can carrying, if the stress is not exceed 120 N/mm^2.

TORSION

Q1. What is pure torsion and torsional rigidity?

Q2. Write torsion equation and name each term.

Q3. What assumptions are made while deriving the Torsion equation?

Q4. Derive the torsion equation.

Q5. A solid shaft is to transmit a torque of 50K-N. If the shear stress is not to exceed 56 N/mm^2.Find the minimum diameter of the shaft.

Q6. Find the maximum shear stress induced in a solid circular shaft of diameter 200 mm when shaft is to transmit 187.5 kW at 200 rpm.

Q7. What must be the length of a 5m diameter aluminum wire be so that it can be so twisted through one complete revolution without exceeding a shearing stress of 42 N/mm^2. Let $G=2.7X10^4$ N/mm^2.

Q8. A steel shaft is required to transmit 75 KW at 100 r.p.m and maximum twisting moment is 30% greater than the mean. Find the diameter of the shaft, if the maximum stress is 70 N/mm^2. Find the angle of twist in a length of 3 m of the shaft. G=90KN/mm^2.

Q9. A solid shaft of 100 mm diameter is to transmit 160 KW at 100 rpm. Find the angle of twist for a length of 6m if the maximum torque exceeds the mean by 40%. Take C= $8x10^4$ N/mm^2

Q10. What will be percentage saving in material if solid shaft of 100 mm is replaced by hollow shaft to transmit same power at the same maximum allowable stress? The ratio of internal to external diameter is 0.60.

Q11. A solid steel shaft has to transmit 75 KW at 200 r.p.m. taking allowable shear stress as 70 MN/m^2. Find suitable diameter for the shaft, if the maximum torque transmitted on each revolution exceeds the mean by 30%.

Q12. A solid shaft has to transmit 112.5 KW at 250 r.p.m. Taking allowable shear stress as 70 N/mm^2 find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 20%.

Q13. A hollow shaft is to transmit is to 400 KW power at 90 r.p.m. If f_s = 74 N/mm^2 and internal diameter is 0.6 times the external diameter, then find both the diameters assuming the following relations T_{max}= 1.35 T_{mean}.

COLUMNS

Q1. Explain about the failure of Columns.

Q2. What is the difference between strut and column?

Q3. Define

a. Buckling stress,
b. Slenderness ratio
c. Equivalent length of a column
d. Crippling load
e. Bulking factor
f. Bulking load

Q4. Classify columns & state factors on which strength of column depends.

Q5. Find the safe compressive load on a hollow C.I. column, one end rigidly fixed and other hinged, of 150mm external diameter and 100mm internal diameter and 10m in length. Use Euler's formula with F.O.S. of 5 and E= 95KN/mm^2.

Q6. A mild steel tube, 25 mm external diameter, 2.5 mm thick is 3m long and is used as strut. Determine the safe compressive load when this strut is used with the following end condition

a. Both ends are hinged.
b. Both ends are fixed.
c. One end is fixed and the other end is free.

Take factor of safety = 3 and E =2 $\times 10^5$ N/mm^2.

Q7. A hollow C.I. column 200 mm outside diameter and 150mm inside diameter, 8 m long has both the ends Fixed. It is subjected to an axial compressive load. Calculate the safe load by Rankine's formula using a factor of safety as 6.

Take σ_c = 550 N/mm^2 and a = 1/1600.

SPRINGS

Q1. Define the terms:
  a. Spring Index,
  b. Helix angle and
  c. Solid length of a spring.

Q2. State the function of springs & Name different types of springs.

Q3. Why laminations of a leaf spring are of varying length?

Q4. Derive an expression for Maximum Shear Stress Induced in a Coil and Deflection in Closed Coil Helical Spring subjected to Axial Load.

Q5. Show the parts of a Laminated Spring with the help of a neat and well-labeled diagram.

Q6. A close-coiled spring has radius of 40mm and length of 320mm. It is required to extend 21mm under a pull of 185 N. If C=84 GN/m^2, determine the diameter of the wire.

Q7. A laminated spring 600mm long is made up of plates each being 60mm wide and 8mm thick. Find the number of plates required to enable the spring to carry a central point load of 4000N if the permissible bending stress is 120N/mm^2. Also find deflection if E=200KN/mm^2.

Q8. A leaf spring carries a central load of 2500 N. The leaf spring is to be made of 10 steel plates 60 mm wide and 5 mm thick. If the bending stress is limited to 100 N/mm^2, determine
  a. The length of the spring.
  b. Deflection of the spring. Take E=2x105 N/mm^2.

Q9. A closed coil helical spring whose spring index is 8, absorbs 50 N-m of energy when compressed for 50 mm. If the numbers of coil are 10, then calculate.

  a. Diameter of springs
  b. Wire diameter
  c. Maximum shear stress induced
     Take G=84 GPa

S.F. and B.M.

Q1. Classify beam with diagrams.

Q2. What are the different loads acting on a beam? Differentiate between Point load and U.D.L.

Q3. What do you understand by bending moment and point of contraflexure?

Q4. Draw S.F. and B.M. diagrams for a cantilever carrying U.D.L. on its span.

Q5. A cantilever 1.5 m long carries a U.D.L. of 2kN/m over a length of 1.25 m from the free end. It also carries a point load of 3KN at a distance of 0.5 m from the free end. Draw the S.F &B.M diagrams for the given beam.

Q6. A cantilever 2 m long carries a U.D.L. of 2kN/m over a length of 1.5 m from the free end. It also carries a point load of 5KN at a distance of 0.5 m from the free end. Draw the S.F &B.M diagrams for the given beam.

Q7. A Beam 10m span simply supported at its ends carries a load of 20KN/m over the left half of the span and point load of 30KN at the mid span. Draw the S.F & B.M diagrams for the given beam and find the position and magnitude of maximum bending moment.

Q8. A beam AB 10 m long has supports at its ends A and B. It carries a point load of 5KN at 3 m from A and a point load of 5KN at 7 m from A and a U.D.L. of 1KN/m between the point loads. Draw the S.F. and B.M. diagrams.

Q9. A simply supported beam 6m long is carrying a uniformly distributed load of 2KN/m over a length of 3m from the left end. Draw the S.F. and B.M. diagrams for the beam and also calculate the maximum B.M. on the section.

Q10. A simply supported beam of span 9m carries a uniformly distributed load of 20KN/m over the whole span and also two point loads of 30 KN and 40 KN at 6m and 7.5 m respectively from the left support. Draw the shear force and bending moment diagrams.