Topic 6 Strength of Material (SOM)

Past Paper Questions

Q1. The extension of a copper alloy wire 3mm in diameter and 2m long must not exceed 1mm under load. Youngs modulus is 120 GN/m^2 and the ultimate tensile stress is 200 MN/m^2. Calculate

a. The stress in the wire -5m
b. The load in the wire -3m
c. The factor of safety -2m

Q2. A steel wire 5mm in diameter and 2m long carries a tensile load of 1kN. The modulus of elasticity is 200 GN/m^2 Calculate

a. The stress in the wire -5m
b. The extension of the wire -5m

Q3. A single lap joint is fastened with 6 rivets each of diameter 15mm Calculate

a. The tensile load which the joint will withstand if the working shear stress is limited to 30MN/m^2 -5m
b. How many 15mm diameter rivets would be needed if the design load were 50kN -5m

Q4. The safe working load on a steel tie rod 25mm in diameter is 25kN. Given that for the steel 'Youngs Modulus' E=200 GN/m^2 and the tensile strength is 350MN/ m^2. Calculate

a. The working stress -4m
b. The working strain -3m
c. The factor of safety -3m

Q5. A steel wire 10m long and 3mm diameter stretches 2mm when loaded. For the wire $E=200x10^9 N/m^2$ Calculate

a. The strain in the wire -1m
b. The stress in the wire -2m
c. The tensile force in the wire -3m
d. The extension if the wire were changed for one of 6mm diameter -4m

Q6. Two tie rods are joined using a 'Fork and pin' connection. The tension in the rods is 1.5kN and the shear stress in the pin is 40MN/ m^2. Calculate

a. The diameter of the pin -6m
b. The tension which would give the same shear stress in a 6mm diameter pin -4m

Q7. The tensile stress in a brass rod 12mm in diameter and 1.5m long is 10MN/ m^2. Young's modulus for brass = $80x10^9 N/m^2$. Calculate

a. The strain -2m
b. The extension -3m
c. The load (force) on the bar -3m
d. The safety coefficient if the UTS is 25MN/ m^2 -2m

Q8. The extension of a steel wire 2mm in diameter and 4m long must not exceed 2mm under load. Youngs modulus is 210 GN/m^2 and the ultimate tensile stress is 320 MN/m^2. Calculate

a. The stress in the wire -4m
b. The load in the wire -3m
c. The factor of safety -3m

Q9. A steel column has a hollow circular section of 200mm outside diameter and 120mm inside diameter. It is 2m high and carries a compressive load of 800kN. The modulus of Elasticity is 200 GN/m^2 .Determine

a. The stress in the column -4m
b. The change in the height -6m

Q10. a. Calculate the force needed to punch a hole 20mm in diameter in 5mm thick plate if the ultimate shear stress is 200 MN/m^2 -5m

b. Determine the dimension of a square hole that could be punched in the same plate with the same force -5m

Q11. The safe working load on a steel tie rod 25mm in diameter is 25kN. Given that for the steel 'Youngs Modulus' E=200 GN/m^2 and the tensile strength is 350MN/ m^2. Calculate

a. The working stress -4m
b. The working strain -3m
c. The factor of safety -3m

Q12. A steel column 3m high is of a hollow square section 200mm outside dimension and 20mm wall thickness. (Young's Modulus E=$210x10^9 N/m^2$). Calculate

a. The compressive load which will give a stress of 60MN in the column -5m
b. The compression of the column under the load in Q11 a. -5m

Q13. Two tie rods are joined using a "Fork and Pin" connector as shown in fig below. The shear stress in the pin is 30 MN/m^2 and the diameter of the pin is 5mm

Calculate

a. The tension in the ties -6m
b. The tension that would give the same shear stress in a 6mm diameter pin -4m

Q14. A brass tie rod 8mm in diameter and 1m long extends 0.5mm under load. Young's modulus is $80x10^9 N/m^2$. Calculate

a. The strain -3m
b. The stress -3m
c. The load (force) on the bar -4m

Q15. The safe working load on a steel strut of rectangular cross section 20mm X 25mm is 28kN. For steel, E=210x10^9N/m^2 and tensile strength is 380 MN/m^2. Calculate

a. The working stress -4m
b. The working strain -4m
c. The factor of safety -2m

Q16. The crushing stress of concrete is 100 MN/m^2. A short concrete column of square section is to carry a load of 1MN with a safety of factor of 4. Calculate

a. The working stress -4m
b. The section Area -4m
c. The section dimension -2m