

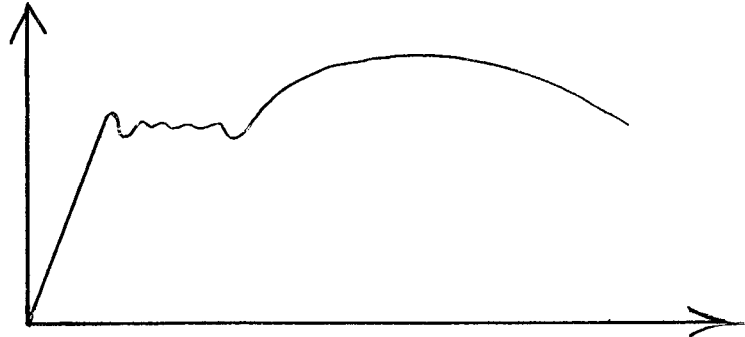


**Question One (20 marks)**

Using your own words, graphs and/or schematic diagrams; answer A, B, and C below.

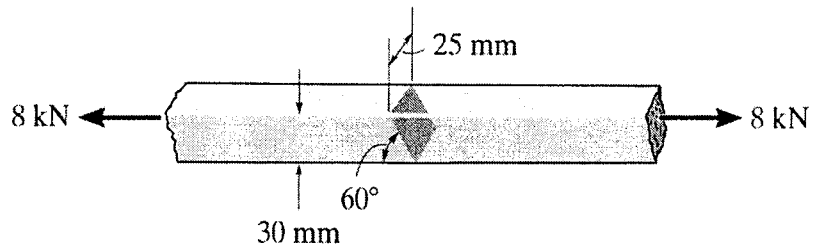
- A) What is the difference between true stress and strain & engineering stress and strain?
- B) Define: Modulus of elasticity (Hooke's law).
- C) Define: Poisson's ratio.
- D) For the stress-strain graph of a ductile material below; copy it to your answer booklet, and label the critical regions and points on the graph.

Use: Upper yield point – failure – linear elastic region – modulus of elasticity "E" – strain – ultimate stress – strain hardening region – stress – post ultimate stress region – yield plateau



**Question Two (20 marks)**

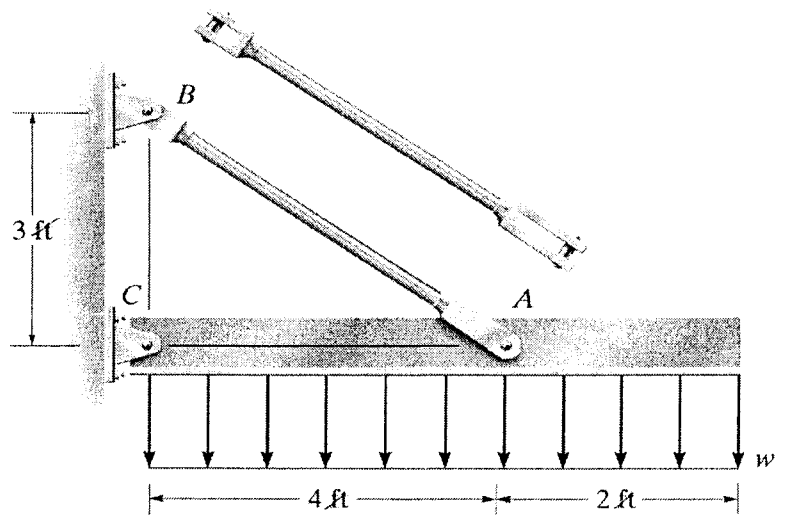
The two steel members are joined together using a 60° scarf weld. Determine the average normal and average shear stress resisted in the plane of the weld.



**Question Three (25 marks)**

The hanger assembly is used to support a distributed loading of  $w = 12 \text{ kN/m}$ . Determine the average shear stress in the 10-mm-diameter bolt at A and the average tensile stress in rod AB, which has a diameter of 12 mm.

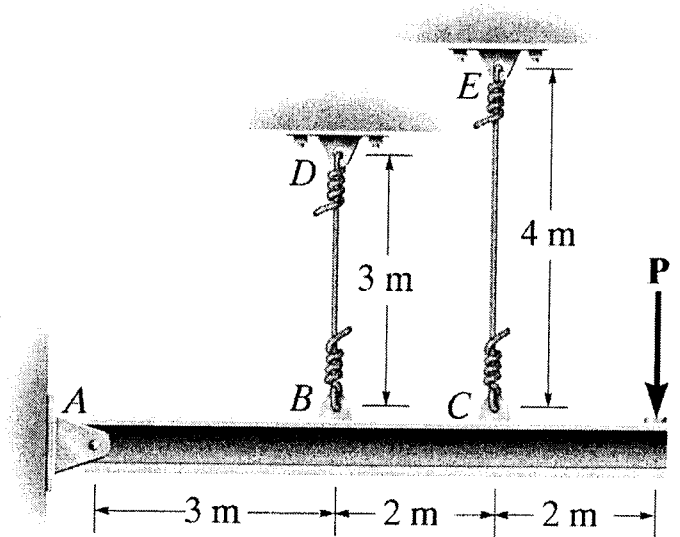
If the yield shear stress for the bolt is  $\tau_y = 175 \text{ MPa}$ , and the yield tensile stress for the rod is  $\sigma_y = 266 \text{ MPa}$ , determine the factor of safety with respect to yielding in each case.



**Question Four (25 marks)**

The rigid beam is supported by a pin at *A* and wires *BD* and *CE*.

If the load *P* on the beam is displaced 10 mm downward, determine the normal strain developed in wires *CE* and *BD*.



**Question Five (25 marks)**

The assembly consists of three titanium rods and a rigid bar AC. The cross-sectional area of each rod is given in the figure. If a vertical force  $P = 20$  kN is applied to the ring *F*, determine the vertical displacement of point *F*.  $E_{ti} = 350$  GPa.

