PAPER :→ Mechanics Of Materials

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Answer NO1 :-

Types of Stress with example including force diagram :-

1. Simple Stress
2. Normal Stress
3. Tensile Stress
4. Compressive Stress
5. Shear Stress
6. Bearing Stress

① Simple Stress :-

Simple Stress are expressed as the ratio of the applied force dividing by the resisting area, or Simple stresses can be classified as normal Stress, Shear Stress and Bearing Stress.

$$\sigma = F/A$$

Where
- σ = Stress [Pa]
- F = Applied Force (N)
- A = Cross Sectional Area

$\sigma = P/A$

Normal Stress:-

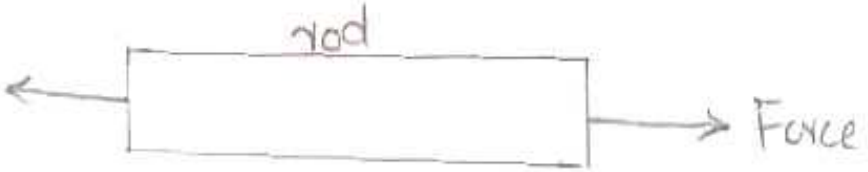
The resisting area is perpendicular to the applied force Called normal Stress.

i. Example of member experiencing pure normal forcess would include column, Collar, ties etc.

Normal Stress can also classified as Tensile Stress and Compressive Stress.

① Tensile Stress:-

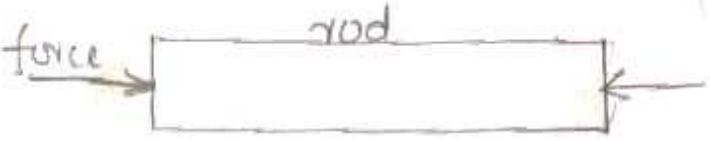
A tensile stress is define as the magnitude F of the force applied along an elastic rod divide by the cross sectional area A of the rod in a direction that is perpendicular to the applied force.



② Compressive Stress:-

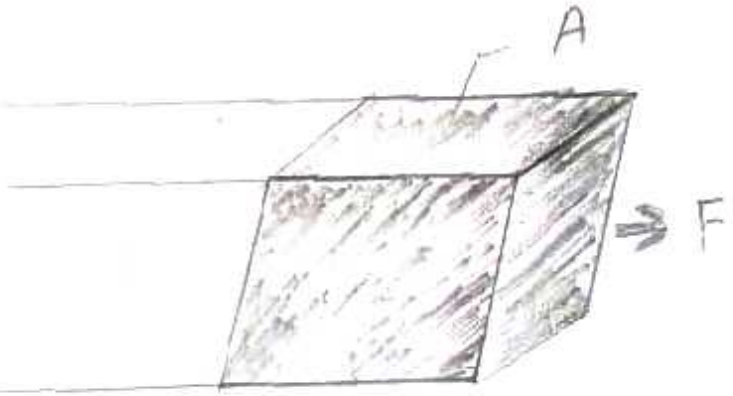
The stress that result from the shortening in one direction of an elastic body due to

oppositely directed collinear forces, tending to crush it.



Shear Stress:-

Force tend to cause deformation of a material by slippage along a plan or parallel to the imposed stress.



Shear Stress $\tau = \frac{F}{A}$

Bearing Stress :-

It is the contact pressure b/w the separate bodies. It differ from compressive stress, as it is internal stress caused by compressive force.

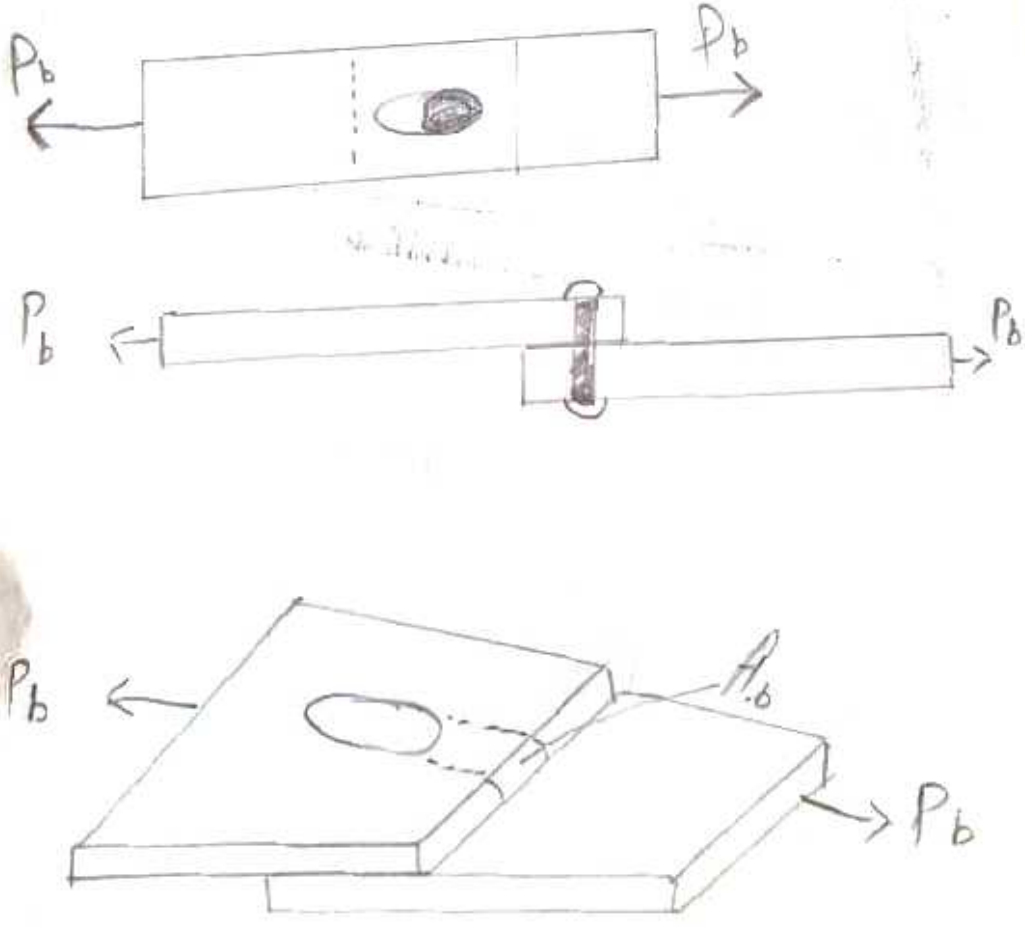
$$\sigma_b = \frac{P_b}{A_b}$$

Where

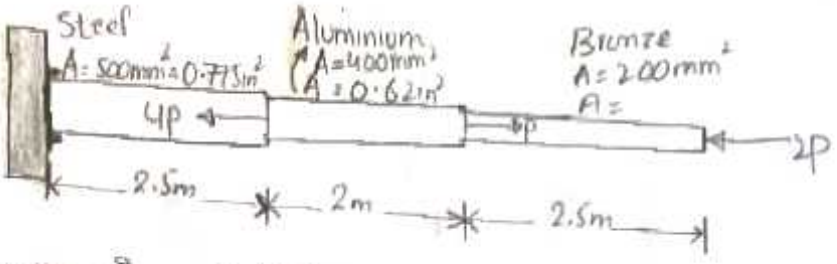
P_b = Compressive load

A_b = Characteristics area perpendicular to P_b.

σ_b = bearing Stress.



Answer NO 2 :-



Conversion of Units

$1mm^2 = 0.00155 in^2$

$1MPa = 145.038 lb/in^2$

$A_{St} = 500mm^2 = 0.775in^2$

$A_{Al} = 400mm^2 = 0.62in^2$

$A_{Br} = 200mm^2 = 0.31in^2$

$\sigma_{St} = 140MPa = 20305.32 lb/in^2$

$\sigma_{Al} = 90MPa = 13053.42 lb/in^2$

$\sigma_{Br} = 100MPa = 14503.77 lb/in^2$

Required :-

$P_{max} = ?$ (For Steel, Aluminum, Bronze)

Solution :-

For Steel

$P_{St} = \sigma_{St} A_{St}$

$= 20305.32 \frac{lb}{in^2} \times 0.775 in^2$

$\boxed{P_{St} = 15736.61 lb}$

or P_{max}

$P_{St} = 4P = 4 \times 15736.61 = \boxed{62946.44 lb}$

For Aluminium

$$P_{Al} = \sigma_{Al} A_{Al}$$

$$P_{Al} = 13053.42 \times 0.65$$

$$\boxed{P_{Al} = 8484.723 lb}$$

For Bronze :-

$$P_{br} = \sigma_{br} A_{br}$$

$$= 14503.77 \times 0.31$$

$$\boxed{P_{br} = 4496.17 lb}$$

or P_{max}

$$P = 2P = 2(4496.17)$$

$$\boxed{P = 8992.34 lb}$$

"Answer No 3"

Given Data :-

Dia of hole = 10mm
Thickness of plate = 15mm
Shear Strength = 250KN/mm²

Required :-

Force = P = ?

Solution :-

Conversion of Units

$1 KN/mm^2 = 1000 MN/m^2$

$\Rightarrow 250 KN/mm^2 = 250,000 MN/m^2$

We know that $\tau = V/A$

$\Rightarrow V = \tau A$

$P = 250,000 [\pi (10)(15)]$

$P = 11780972 4.5 N$

or $\boxed{P = 117809.7 KN}$

Answer.