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Paper BMT

Q3(b) Differentiate between stable and unstable Equilibrium and give proper example you will observe in daily life.

Ans/ Stable Equilibrium:-

A body is said to be in stable equilibrium if after a slight tilt it returns to its previous position.
its center of gravity is at lowest position when it is tilted, its center of gravity rises. it returns to its stable equilibrium as longer as the center of gravity acts throug the base of the body.
for example.
A book lying on the table tilt the book slightly about its one edge by lifting it from the opposite side it returns to its previous position when sets free.

Unstable equilibrium:
if a body does not return to its previous position when sets free after the slightest till it said to be in unstable equilibrium.
The center of gravity of the body is at highest position in the stable of unstable equilibrium As the body topples over about its base its center of gravity move toward its lower position and does not return to its previous position.
for example:
Take a pencil and try to keep it in the vertical position on its tip. whenever you leave it the pencial topples over about it tip and fall down. This is called an unstable equilibrium. in an unstable equilibrium, a body may be made to stay only for a moment.

Q4/ Define Stress and following terms
- Tensile Stress
- Compressive Stress
- Shear Stress

Stress:
when the deforming force is applied to an object deforms in order to bring the object back to the original shape and size, there will be an opposing force generated inside the object.
The restoring force will be equal in magnitude and opposite in direction to the applied deforming force. The measure of this restoring force generated per unit area of the material is called stress.

Tensile Stress:
if the deforming force or applied force results in the increase in the object's length then the resulting stress is termed as tensile stress.
for example: when a rod or wire is stretched by pulling it with equal and opposite force at both end.

Compressive stress:
if the deforming force or applied force results in the decrease in the object length then the resulting stress is termed as compressive stress. for example. when a rod or wire is compressed squeezed by pushing it with equal and opposite force (inward) at both ends.

Shearing stress:
forces parallel to the area resisting the force cause shearing stess. it differs to tensile and compressive stresses, which are caused by force perpendicular to the area on which they act. shearing stress is also know as tangental stress.

$$\tau = \frac{V}{A}$$

where V is the resultant shearing force which passes through the centroid of the area A being sheared.

or when the direction of the deforming force or external force is parallel to the cross sectional area, the stress experienced by the object is called shearing stress.

Q1/ Define strain and a cord has original length of 100cm is pulled by a force. The change in length of the cord is 2mm. Determine the strain?

Strain:

Strain simply the measure of how much an object is stretched or deformed. Strain occurs when force is applied to an object. Strain deals mostly with the change in length of the object. if the original length of the body L_o changes by ΔL, then stress can be expressed as

Strain $\frac{\Delta L}{L}$ = $\frac{\text{Change in length}}{\text{original length}}$.

Solve the numerical

Given data

original length(l_0) = 100cm = 1m

The change in length(Δl) = 2mm = 0.002m

Strain = ?

Sol:

Strain = $\frac{\text{the change length}(\Delta L)}{\text{original length}(l_o)}$

Put the value in formula

$$\text{Strain} = \frac{0.002m}{1m}$$

$$\boxed{\text{Strain} = 0.002} \text{ Ans}$$

Q2 a) if a tensile load of 5N is applied on a rectangular bar as shown in the figure. where height of the bar is 8cm and breadth is 15cm. calculate the tensile stress in the bar.

Given data

Applied load = F = 5N

Rectangular bar dimensions.

Height = h = 8cm

$h = 8 \times 10^{-2} m$

Breadth = b = 15cm

$b = 15 \times 10^{-2} m$

Required

Stress in the bar = σ = ?

formula

$\sigma = F/A$

To find the stress first we will find the cross sectional area of the bar.

formula:

$A = b \times h$

$= (8 \times 10^{-2} m) \times (15 \times 10^{-2} m)$

$= 8 \times 15 (10^{-2})^2 m^2$

$= 120 \times 10^{-4} \times m^2$

Stress = σ = F/A

= 5N / [120 x 10^-4 x m2]

= (5 x 10^4) N / 120m2

= 416 N/m2 Ans

Q2b) if a compressive load of 10N is applied on a rectangular bar as shown in the figure. where height of the bar is 8 cm, breadth is 15 cm and length 30 cm. Calculate the compressive stress in the bar.

Given data

Applied load = F = 10N

Rectangular Bar dimensions.

Height = h = 8cm

h = 8 x 10^-2 m

Breadth = b = 15cm

b = 15 x 10^-2 m

Length = L = 30cm

L = 30 x 10^-2 m

Required:

Stress in the bar = σ = ?

formula

σ = F/A

To find the stress first we will find the cross sectional area of the bar.

formula 2.

A = L x b

= (30 x 10^-2 m) x (15 x 10^-2 m)

$= 30 \times 15 (10^{-2})^2 \times m^2$
$= 450 \times 10^{-4} m^2$

Stress $= \sigma = F/A$
$= 10N$
$[450 \times 10^{-4} \times m^2]$
$= (10 \times 10^4) N$
$450 m^2$
$= 222.22 N/m^2$ Ans

Q3(a) Briefly explain principal of momentum and momentum of sea saw?

Principle of moment:
The principle of moment State that when in equilibrium the total sum of the anti clock wise moment is equal to the total sum of the clock wise moment.
when a system is stable or balance it is said to be in equilibrium as all the force acting on the system cancel each other out.
or The principle of moments state that when a body is balanced, the total clockwise moment about a point equal the total conticlockwise moment about the same point.

Moments of sea saw:

Both people exert a downward force on the seasaw due to their weight.

Person As weight is trying to turn the seasaw anticlockwise whilst person B's weight is trying to turn the seasaw clockwise.

Person A's moment = force x perpendicular distance from fulcrum

500 x 2 = 1000 Nm

Person A's moment = persons B's moment

Anticlockwise moment = clock wise moment