

STRENGTH OF MATERIALS

Strength Of Materials :

- **Mechanics of materials**, also called **strength of materials**, is a subject which deals with the behavior of solid objects subject to stresses and strains.
- The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts.

Rigid Body:

- A rigid body is defined as a body on which the distance between two points never changes whatever be the force applied on it.
- Practically, there is no rigid body.

Deformable body:



A deformable body is defined as a body on which the distance between two points changes under action of some forces when applied on it.

Stress :



Stress is the applied force or system of forces that tends to deform a body.

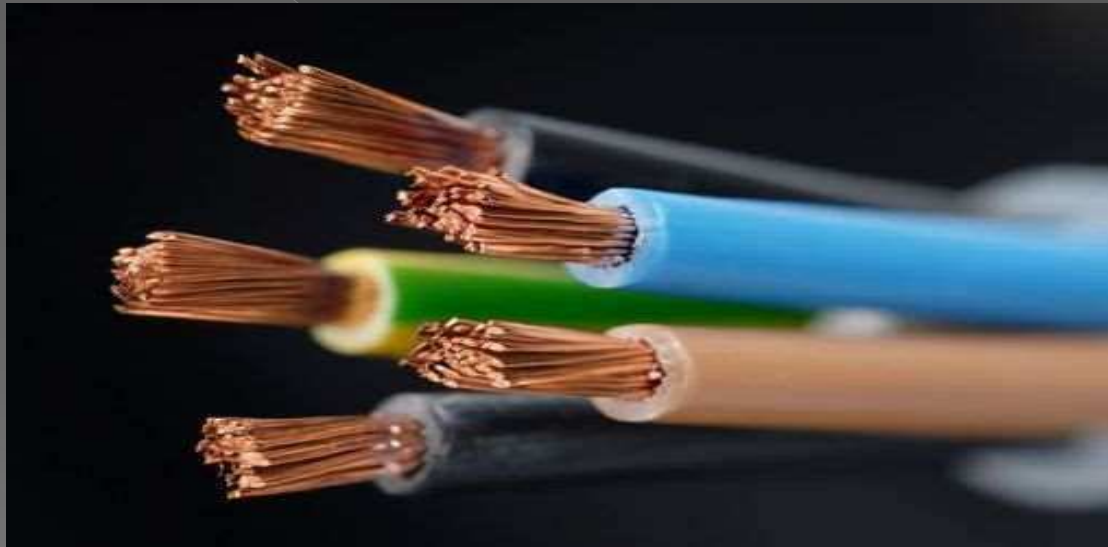
Tensile stress:

- A force that attempts to pull apart or stretch a material.
- Example :



Ductile behavior:

- Ductility is a solid material's ability to deform under tensile stress.



Copper wires

Compressive stress:

- ◉ A force that attempts to squeeze or compress a material.



- ◉ Here, the UTM is testing a concrete block.

Brittle behavior:

- A material is brittle if, when subjected to stress, it breaks without insignificant deformation.
- Glass is a good example.



Young's Modulus:

- Young's modulus, also known as the tensile modulus or elastic modulus, is a measure of the stiffness of an elastic material.
- Named after a British Scientist THOMAS YOUNG
- Its unit is “pa” or N/m^2

Thomas Young:



Shear Stress:



Skating

Strength of A Material:

- Strength is the ability to resist deformation.
- The strength of a component is usually considered based on the maximum load that can be borne before failure.

Poisson's Ratio:

- Poisson's ratio, named after Simeon Poisson, is the negative ratio of transverse to axial strain.
- When a material is compressed in one direction, it usually tends to expand in the other two directions perpendicular to the direction of compression.
- This phenomenon is called the Poisson Effect.

Simeon Poisson:



Thermal Stress:



Baking

Thermal stress:



Thermal stress acting on the rails.

Stiffness:

- Stiffness is the rigidity of an object the extent to which it resists deformation in response to an applied force



Golf bats have high stiffness

Axial Load:

- Axial loading occurs when an object is loaded so that the force is normal to the axis that is fixed.



Co-efficient of thermal expansion:

- The degree of expansion divided by the change in temperature is called the material's co-efficient of thermal expansion and generally varies with temperature.



Tensile strength:

- Tensile strength (TS) or ultimate strength, is the maximum stress that a material can withstand while being stretched or pulled before failing or breaking. Tensile strength is not the same as compressive strength and the values can be quite different.

Bending:

- Bending (also known as flexure) characterizes the behavior of a slender structural element subjected to an external load applied perpendicularly to a longitudinal axis of the element.



Stability of a structure:

- ◉ Structural stability can be defined as the power to recover equilibrium.

Compressive strength:

- Compressive strength is the capacity of a material or structure to withstand loads tending to reduce size.

Thin shell:



egg shell.

Spherical Shell:



Spherical container carries Oil, Acid and chemicals.

Glue joint:



The wooden boards are joint using glue.

Propped Cantilever:



A traffic signal post

Overhanging beam:



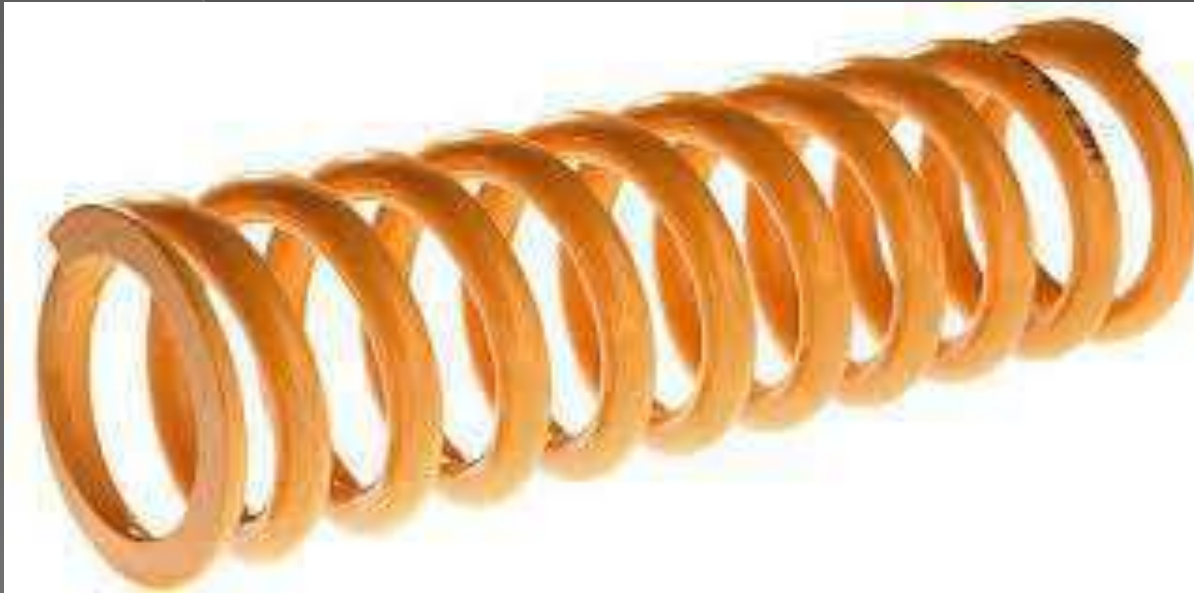
World's largest overhanging roof- Busan Cinema Center (South Korea)

Hardened Materials:



High Speed Steel tools

Helical springs:



Helical springs used in suspension

Strain

- Strain, represented by the Greek letter ε , is a term used to measure the deformation or extension of a body that is subjected to a force or set of forces.
- The strain of a body is generally defined as the change in length divided by the initial length.
- $\varepsilon = \Delta L / L$

Buckling of column:



Columns buckle due to over weight.

Cup & Cone Fracture:



Cup & cone fracture in tension testing

Sagging:



Sagging In bridge occurs due to weight of people.

Hogging:



Hogging happens in pole vault stick due to his Weight.

Heterogeneous material:



Gun bullets made with two different materials.

Simply supported Beam:



The central horizontal beam is a simply supported beam.

Bi-Axial Load:



In safety Nets, Tension acts in both X & Y directions.

UDL:



Water's weight is distributed uniformly all over the dams.

Inclined plane:



Inclined planes used for transporting objects

Homogeneous material:



Wood

Deformation due to self weight:



The bar attains elastic deformation due to self weight.

Short column:



Short column in car parking.

Cylindrical shells:



Body of an airplane.

Strain energy:



Pogo sticks uses the strain energy for jumping.

Continuous beam:



Danyan Kunshan Grand Bridge

Change in volume:



Cantilever beam:



Cantilever house.

Fatigue load:



The thermal load applied on the rails continuously.

Three point bending:



Simple bar:



Baseball bat.

UVL:



The loads in the strings of suspension bridge varies uniformly.

Isotropic material:



Connecting rod – material property doesn't depend on direction.

Bending moment:

A bending moment is the reaction induced in a structural element when an external force or moment is applied.

Fixed beam:



Stonehenge in England

Stepped bar:



Stepped Bolt

Tapered Bar:



Key used in Lathe

Uni-axial load:



Kite Surfing

Long Columns:



Columns in White House

Elastic Deformation:



Archery

Plastic deformation:



Destruction of buildings

Shear Load:



Ironing !

THANK YOU

References:

- ⦿ www.wikipedia.com
- ⦿ www.britannica.com
- ⦿ www.engineersedge.com

STRENGTH OF MATERIALS

TERM PAPER

By

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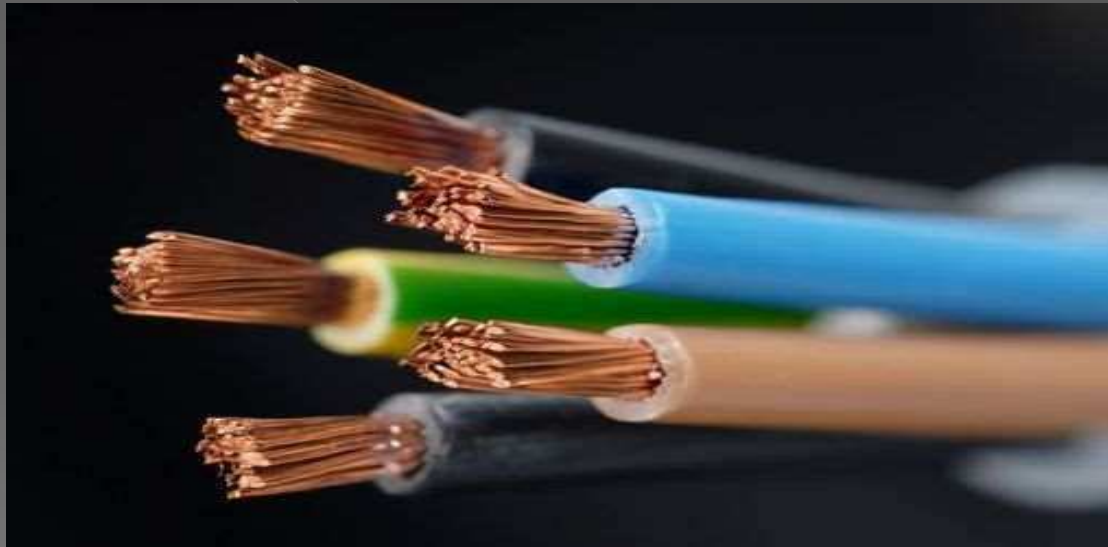
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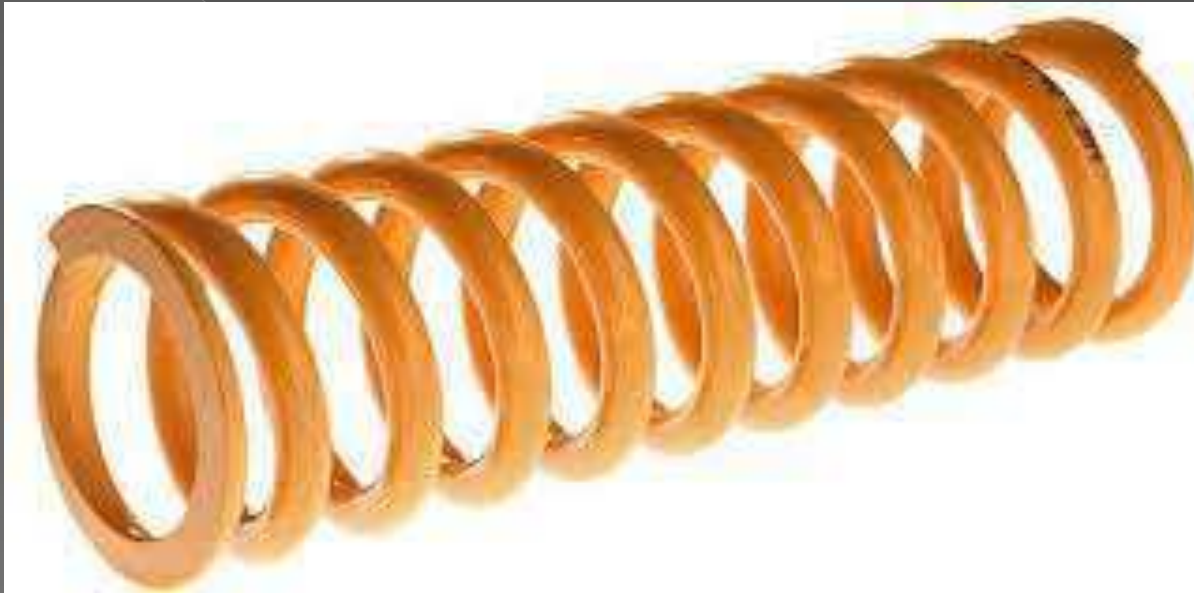
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