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Subject # Eng Mechanics

Shear Force

A shear force is a force applied perpendicular to the surface in opposition to an offset force acting in the opposite direction. This result in a shear strain. In simple terms, one part of the surface is pushed in one direction while another part of the surface is pushed in the opposite direction.

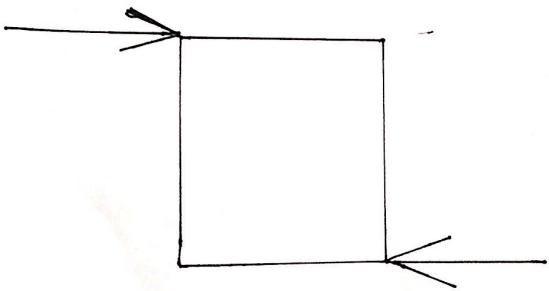
This different to compression which occurs when the two opposing forces are pushing into each other at the same point. (i.e they are not offset). resulting in compressive stress.

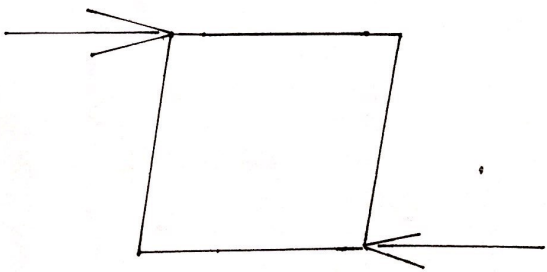
When a structural member experiences failure by shear, two parts of it are pushed in different directions for example, when a piece of paper is cut by scissors.

Large or high-rise buildings must be designed with shear walls to provide resistance to shear forces, which

Which might otherwise push over parallel structural elements of building, in what is known as racking

Diagrams





Bending Moment :-

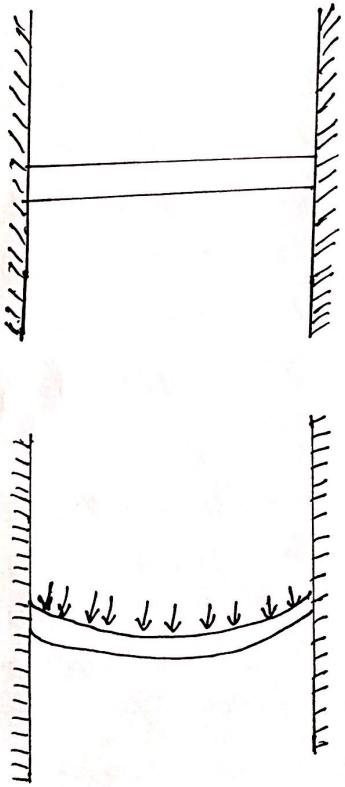
A bending moment (BM) is measure of the bending effect that can occur when an external force (or moment) is applied to structural element. This concept is important in structural engineering as it is can be used to calculate where, and how much bending may occur when forces are applied.

The most common structural element that is subject to bending moments is the beam, which may bend when loaded at any point along its length.

Failure can occur due to bending when the tensile stress exerted by a force is equivalent to or greater than the ultimate strength (or yield stress) of the element. However although the mechanism are different, a beam may fail due to shear force before failure in bending.

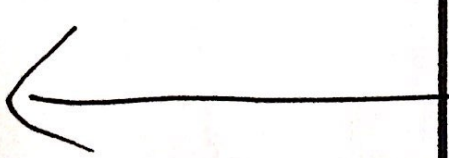
If a beam is not well-restrained a bending force may cause it to rotate about a pivot point.

To calculate the bending moment the magnitude of the force is multiplied by the distance of the force from the point of support.



Moment of resistance

When a beam bend under load, the horizontal fibres will change in length. In technical terms it is refered to as the internal moment of resistance. The tensile and compressive stresses result in a turning effect about the neutral axis. These are called moment M_T and M_C respectively.

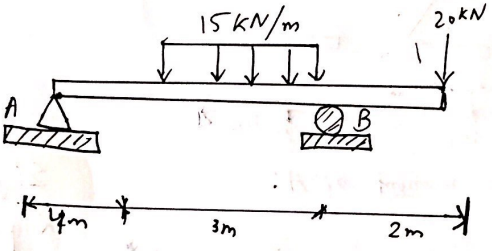


Bending Moment

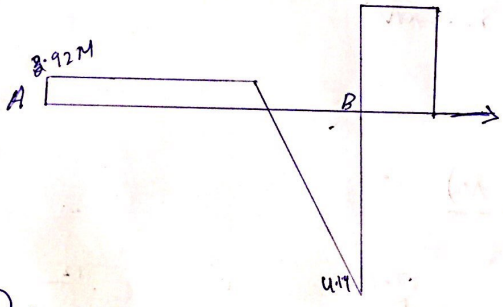
* A bending moment is the reaction induced in a structural element when an external force or moment applied to the element causing the element to bend. The most common or simplest structural element subjected to bending moments is the beam. ~~The diagram~~

Question # 2

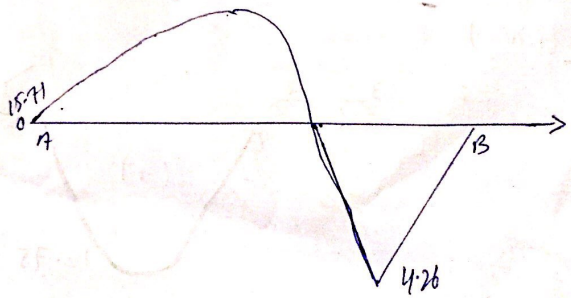
Part A:-



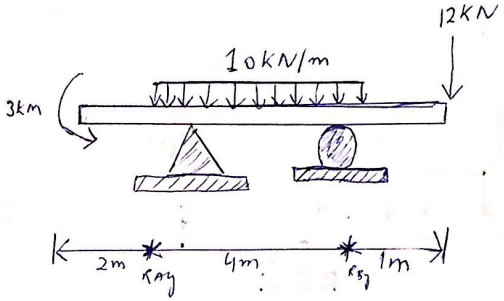
Sol:- SFD Diagram



BMD:



Part # B



By taking the moment of A:

$\Sigma M_A = 0$

$-R_{By} \times 4 - 3 + 10 \times 4 \times 4/2 + 12 \times 5 = 0$

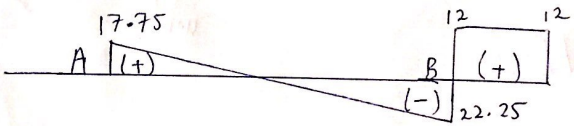
$R_{By} = 34.25\ kN$

$\Sigma F_y = 0$

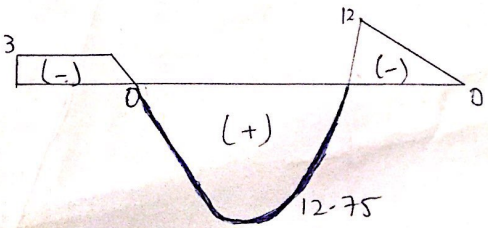
$R_{Ay} + R_{By} = 10 \times 4 + 12$

$R_{Ay} = 17.75\ kN$

SFD (kN)



BMD (kNm)



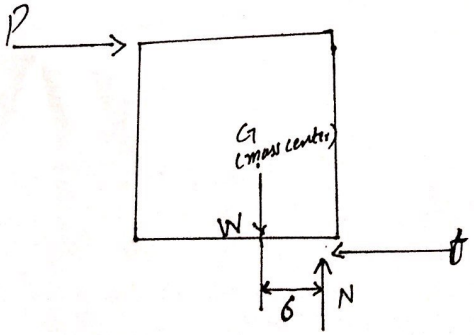
Question #3

Coulomb's Theory of Friction:

the law states that for two or dry solid surface sliding against one another, the magnitude of the kinatic friction exerted through the surface is independent of the magnitude of the velocity i.e the speed of the slipping of the surface against each other.

Coulomb Friction:

- opposes impending motion.
- Is tangent to the surface of contact.
- Is a function of the normal force and the surface material.



Power:

Power is the amount of energy transferred or converted per unit time. In the International System of units, the Unit of Power is the Watt, equal to one joule per second. In older works, power is sometimes called activity. Power is Scalar quantity.

Energy:

Energy is the capacity of a physical System to do work. the common symbol for energy is uppercase letter E. the Standard unit is the joule, symbolized by J. one joule (1J) is the energy Resulting from the equivalent of one newton (1N) of force acting over one meter (1m) of displacement.

Newton Equation of Motion:

Newton's second law, which states that the force F acting on a body is equal to the mass m of the body multiplied by the acceleration of its center of mass. $F = ma$ is the basic equation of motion.

Principal Axis: A line that passes through the center of curvature of a lens so that light is neither reflected nor refracted; "in which objects are seen most distinctly" optic axis.

Radius of Gyration: Radius of gyration or gyradius of a body about an axis of rotation is defined as the radial distance to a point which would have a moment of inertia the same as the body's actual distribution of mass, if the total mass of the body were concentrated.

Work: work is done when a force that is applied to an object moves that object. The work is calculated by multiplying the force by the amount of movement of an object ($W = F \times d$) A force of 10 newtons that moves an object 3 meters does 30 n—m of work.