आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

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Engineering Mechanics

BEAM

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Introduction to Beam

Types of Beam

1. **Overhanging beam**-These types of beams are extended beyond the support. They can be extended on either sides or both sides.

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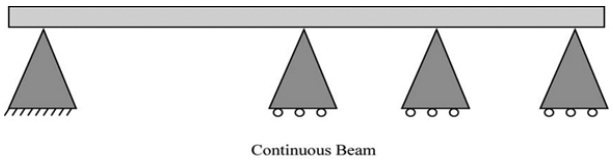
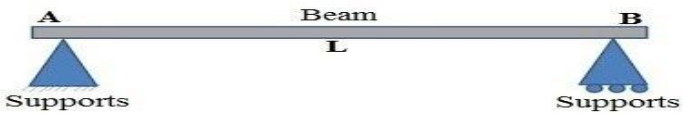
2. **Cantilever beam**- This beam is fixed at one end and free another end.

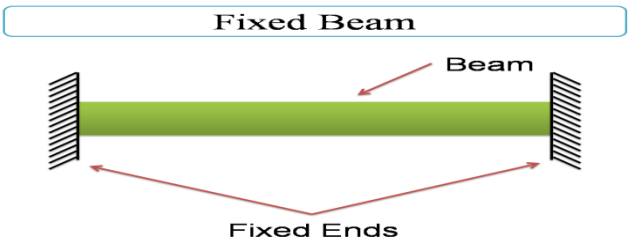
3. **Continuous beam**-This types of beams have more than two supports.



4. **Simple supported beam-** A simply supported beam is one that rests on two supports and is free to move horizontally.

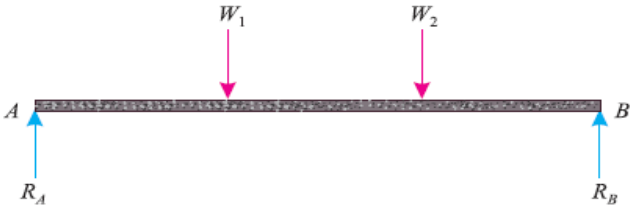


5. **Fixed beam-**These types of beams are fixed at both ends



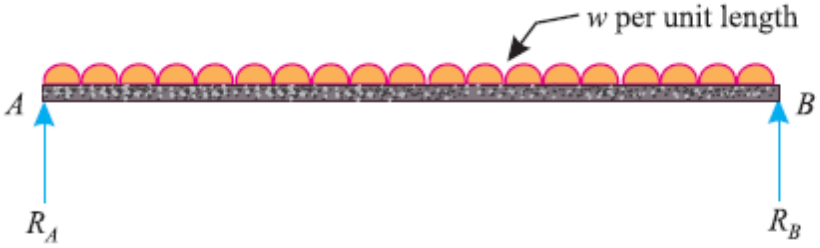
Types of Load

1. **Point load- T**hese types have load act at a particular point and they can be moved along the line of action of the forces

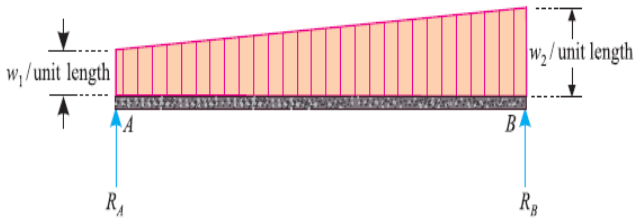


2. **Uniformly distributed load-** These types of load are distributed along the length uniformly .The total weight of the udl is calculated by multiplying its length to its weight intensity that is its weight per unit length

Total weight of udl=Weight intensity × length



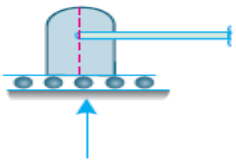
3. **Uniformly varying load-** These types of load have varying load intensity. Weight Per unit length is not constant and it varies along the length. Total load is calculated by measuring area under the curve.



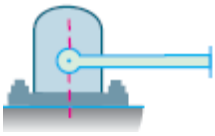
Types of support

1. **Simple support-**The direction of reaction in this types of support are normal to support .The beam simply rest on these support.

2. **Roller support.** In these types of support the direction of reaction is normal to support. The end of the beam rest on the roller provided.



3. **Hinged Support.** In these types of support reaction may be horizontal, vertical and inclined depending upon load .The end of the beam is hinged on the support .Bridge trusses have hinge support as one of their support.

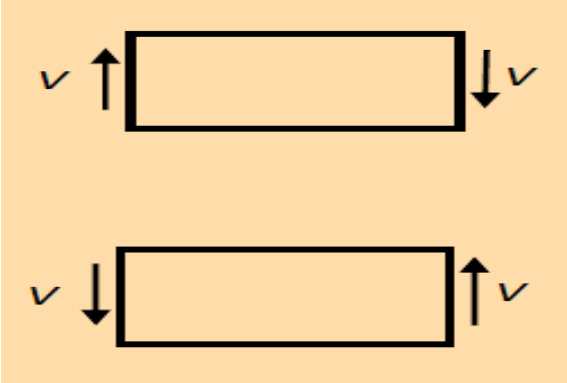


Shear Force and Bending moment

Shear force – It is the force which tries to shear off the section

How to calculate shear force –It is calculated by adding all the forces acting either left of the section or right of the section.

Sign Convention-Forces acting upward on the left of the section are considered positive while forces acting downward are considered negative .Similarly forces acting downward on the right of the section are considered positive while acting upward are considered negative



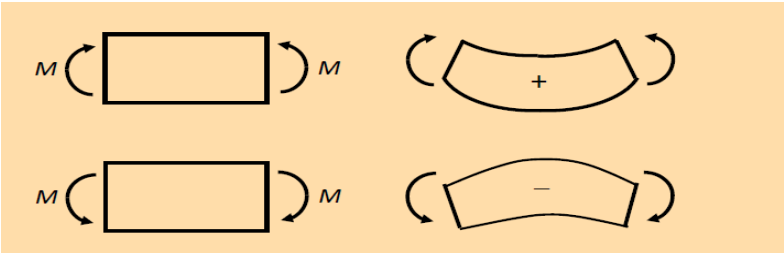
1. Fig shows positive shear force

2. Fig shows negative shear force

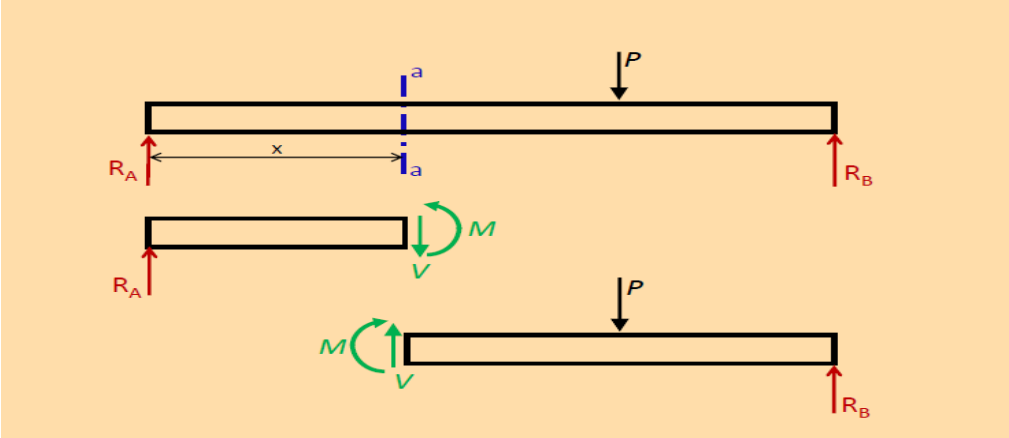
Bending moment- It is a moment which tries to bend the beam

How to calculate Bending Moment- it is calculated by adding all the moments of the forces acting either left of the section or right of the section

Sign Convention –Moment of the forces acting upward are considered positive either acting left of the section or right of the section. While moments of forces acting downwards are considered negative either left of the section or right of the section.
OR
Anticlockwise moment on the right of the section and clockwise wise moment on the left of the section are considered positive and vice versa.



Method to calculate shear force and bending moment



V= Shear force

=The forces that tends to separate the member

=Balances the reaction R_A

M=Bending moment

=the reaction moment at a particular point (section)

=balances the moment R_Ax (x is the distance of R_A from section a-a)

From equilibrium

$\Sigma F_y=0$ R_A -V=0

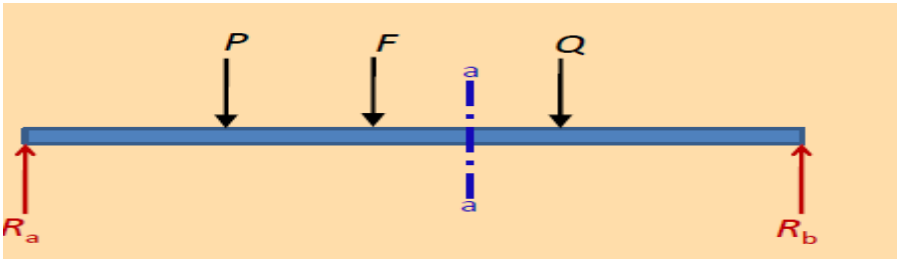
$V=R_A$

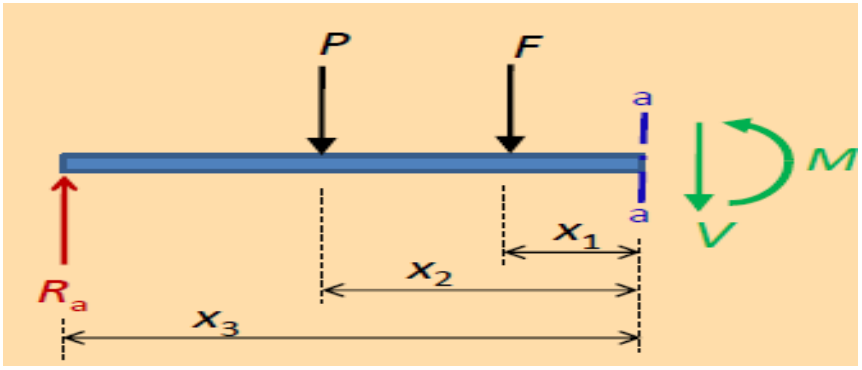
$\Sigma M=0$

$-M+R_AX=0$

$M=R_AX$

Example-Calculate Shear Force and Bending Moment





$\Sigma F_y=0$

R_A-P-F-V=0 V is shear force at section a-a

$V=R_A-P-F$

$\Sigma M=0$

$-M-FX_1-PX_2+R_AX_3=0$ M=Bending Moment at section a-a

$M=R_AX_3-FX_1-PX_2$

References

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2.A text book on Engineering mechanics by R.S Khurmi S.Chand publication

3. https://iiitn.ac.in