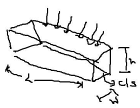
ME1020 - Beams (SFD & BMD)

Beams: Transversely loaded members with one dimension much larger than other two dimension

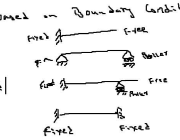


$L >> h$

$L >> w$

Classification of Beams based on Boundary Conditions:

1) Cantilever
2) Simply supported
3) overhanging beam (propped)
4) Fixed - Fixed Beam



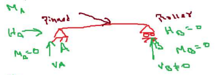
(1), (2): determinate

(3), (4): indeterminate beam

Forces acting on the Beams

1) Cantilever Beam

What is Fixed end: • no translation (x, y) — H_A, V_A
• no rotation — M_A



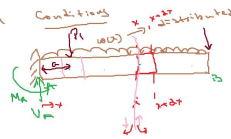
what is Pinned end: no Translation
yes to rotation

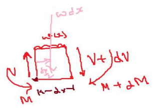
What is Roller end: no y translation V_B
yes x translation $H_B = 0$
yes θ to rotation $M_B = 0$

What is Free end: yes to translation $V_B = 0$, $H_B = 0$
yes to rotation $M_B = 0$

No reactions.

Equilibrium Conditions





FBD

Infinitesimal length of the beam

Equations of Equilibrium

$\Sigma F_y = 0$: $V - (V + dV) - w\,dx = 0$ — ①

$\Sigma M_z = 0$: $M - (M + dM) - (V + dV)\,dx - w\,dx\,\frac{dx}{2} = 0$ — ②

($dV \approx 0$; $w\,dx \cdot \frac{dx}{2} \approx 0$, neg.)

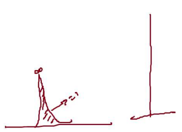
$\Sigma F_x = 0$: trivially zero

$$\frac{dV}{dx} = -w(x)$$

Rate of change of (V:) shear force is load: y

$$\frac{dM}{dx} = -V$$

Rate of change of BM is SF



$w(x) = P_1\,\delta(x - a)$