Engineering Mechanics

ME-205F

Second year B.Tech Degree

Kinematics

- Concept of rigid body
- Velocity
- Acceleration
- Relative velocity
- Translation & rotation of rigid bodies
- Equations of motion for translation & rotation

Energy & Momentum method

Principle of Work and Energy for a Rigid Body

for a system of particles

$$T_1 + U_{1\to 2} = T_2$$

consider a rigid body is made of large number of particles

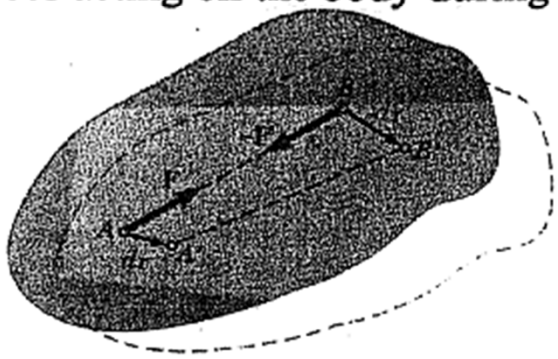
T_1, T_2 : initial and final values of total kinetic energy of the particles forming the rigid body

$U_{1\to 2}$: work of all forces acting on the various particles of the rigid body

total work due to internal forces acting on the particle of the rigid body is zero, thus $U_{1\to 2}$ is the work of external forces acting on the body during the displacement considered

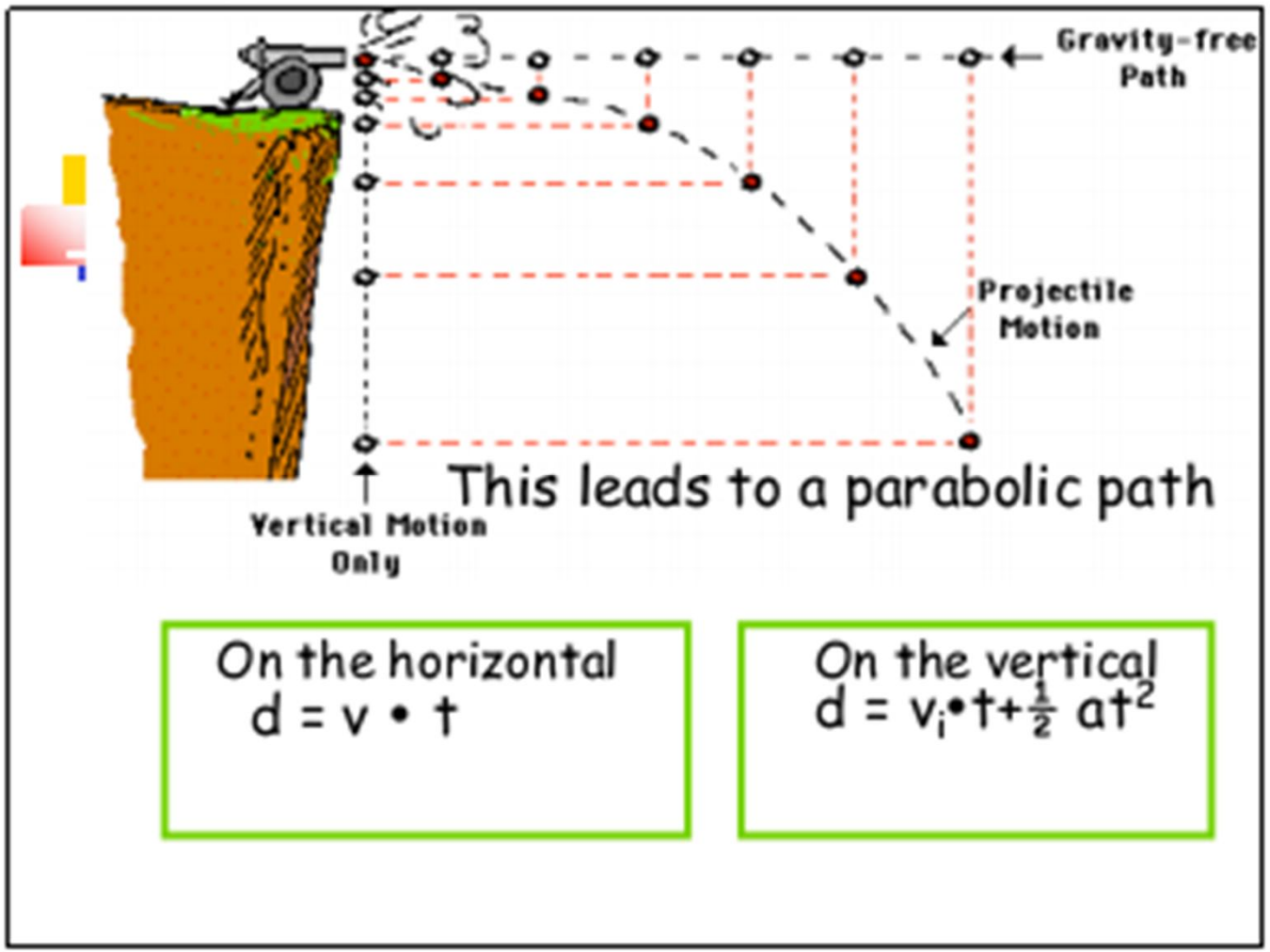
the kinetic energy can be expressed

$$T = \tfrac{1}{2} \sum_{i=1}^{n} (\Delta m_i)\, v_i^2$$

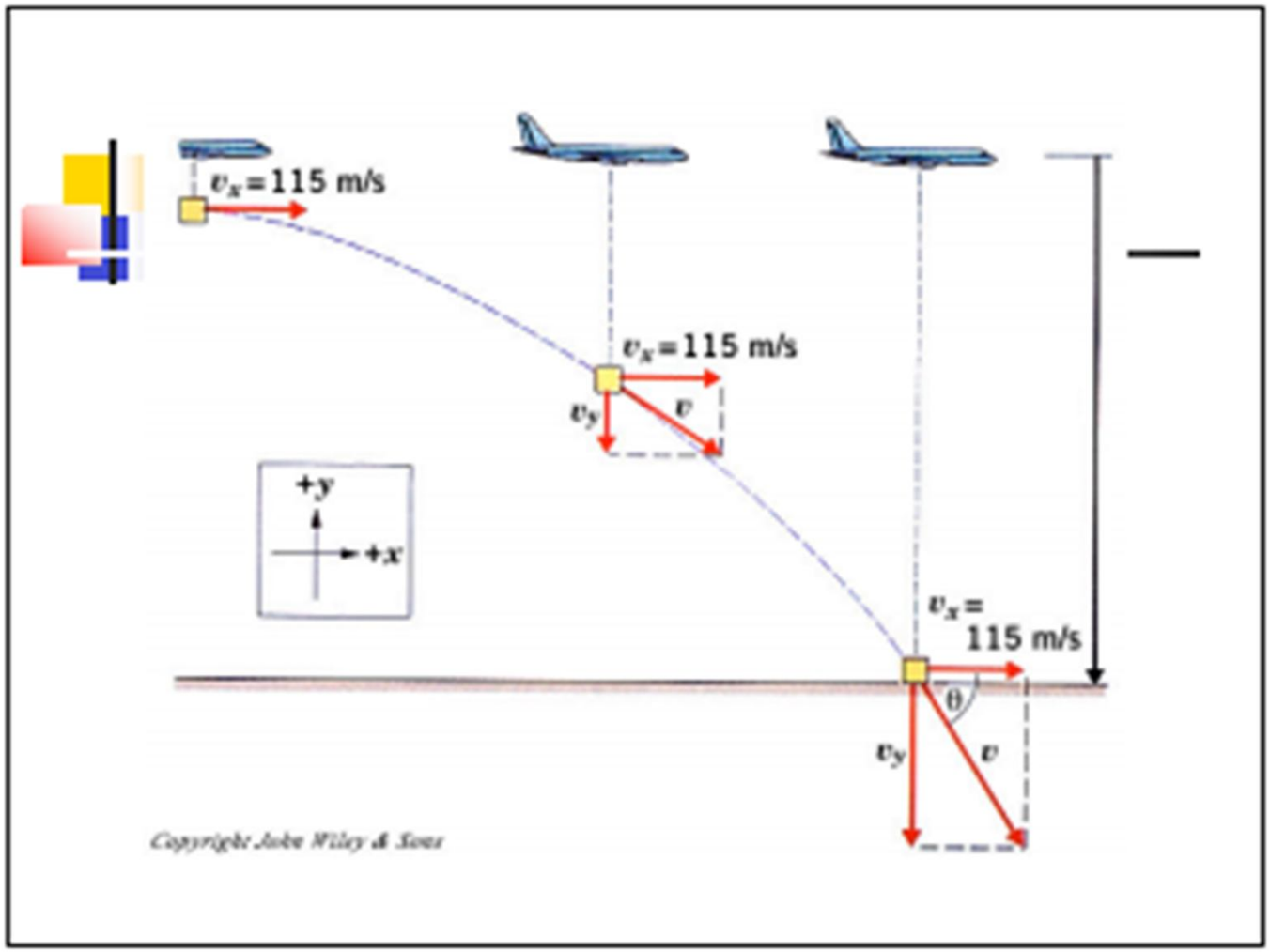


- Newton’s law
- Linear momentum
- Angular momentum

Projectile


Gravity-free Path
Projectile Motion
This leads to a parabolic path
Vertical Motion Only
On the horizontal
d = v • t
On the vertical
d = v_i•t+½ at²

Projectile


$v_x = 115$ m/s
$v_x = 115$ m/s
v_y
v
+y
+x
$v_x =$
115 m/s
θ
v_y
v
Copyright John Wiley & Sons

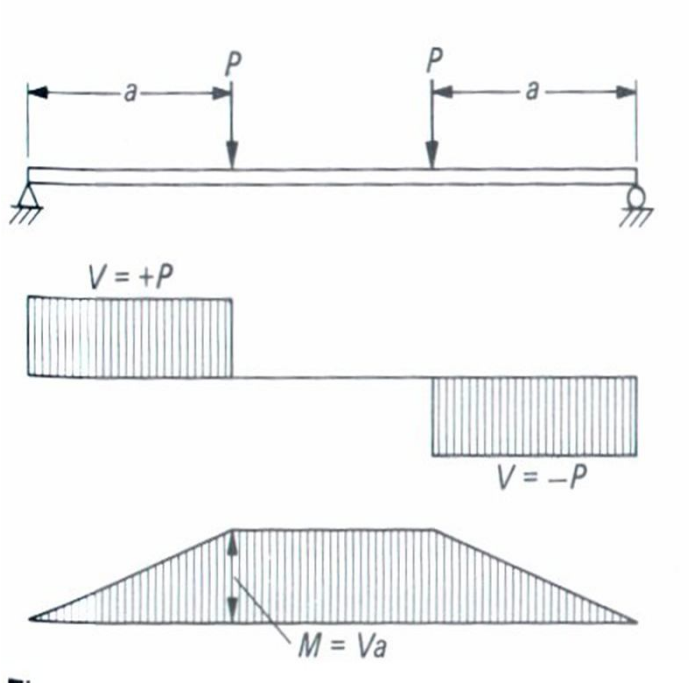
Shear force & Bending moment

- **Shear Force:** is the algebraic sum of the vertical forces acting to the left or right of a cut section along the span of the beam

- **Bending Moment:** is the algebraic sum of the moment of the forces to the left or to the right of the section taken about the section

Bending of beams

- **It is important to distinguish between pure bending and non-uniform bending.**
- **Pure bending is the deformation of the beam under a constant bending moment. Therefore, pure bending occurs only in regions of a beam where the shear force is zero, because V = dM/dx.**
- **Non-uniform bending is deformation in the presence of shear forces, and bending moment changes along the axis of the beam.**



SFD & BMD Simply Supported Beams