Chapter 11 – Equilibrium and Elasticity

I. Equilibrium
- Definition
- Requirements
- Static equilibrium

II. Center of gravity

III. Elasticity
- Tension and compression
- Shearing
- Hydraulic stress

I. Equilibrium

- Definition: An object is in equilibrium if:

- The linear momentum of its center of mass is constant.

- Its angular momentum about its center of mass is constant.

Example: block resting on a table, hockey puck sliding across a frictionless surface with constant velocity, the rotating blades of a ceiling fan, the wheel of a bike traveling across a straight path at constant speed.

- Static equilibrium:

$$\vec{P} = 0, \qquad \vec{L} = 0$$

Objects that are not moving either in TRANSLATION or ROTATION

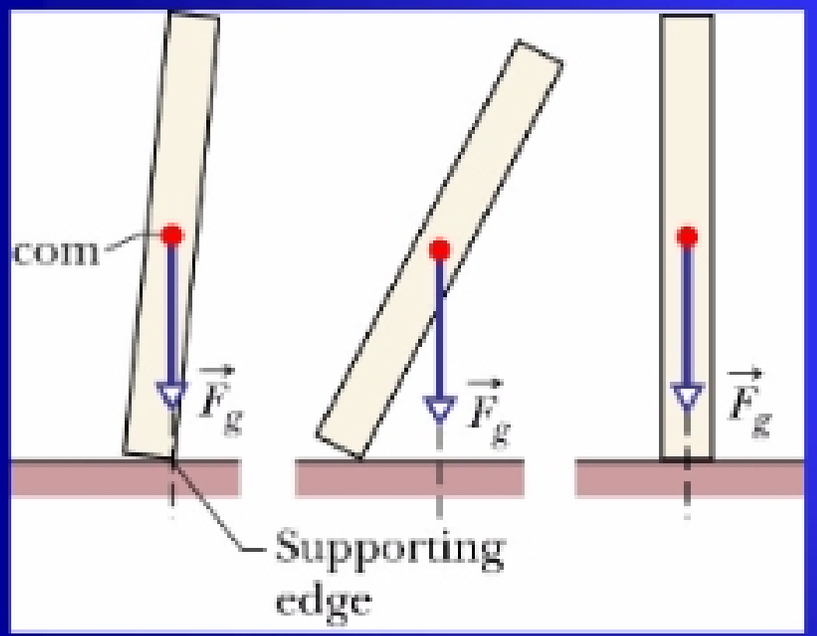
Example: block resting on a table.

Stable static equilibrium:

If a body returns to a state of static equilibrium after having been displaced from it by a force → marble at the bottom of a spherical bowl.

Unstable static equilibrium:

A small force can displace the body and end the equilibrium.



(1) Torque about supporting edge by F_g is 0 because line of action of F_g passes through rotation axis → domino in equilibrium.

(2) Slight force ends equilibrium → line of action of F_g moves to one side of supporting edge → torque due to F_g increases domino rotation.

(3) Not as unstable as (1) → in order to topple it, one needs to rotate it beyond balance position in (1).