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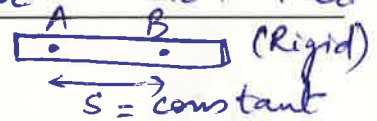
Engineering Mechanics:-

- Free body Diagrams & equilibrium
- Friction
- Truss
- Virtual Work
- Dynamics (Particle & Rigid body)
- Collision (theory)

Mechanics:- It is defined as that branch of Science, which describes and predicts the condition of rest or motion of bodies under the action of forces.

Statics:- Statics deal with the condition of equilibrium of bodies acted upon by forces.

Rigid body:- A rigid body is defined as a definite quantity of matter, the parts of which are fixed in relative to each other.



Force:-

Force may be defined as any action that tends to change the state of Rest or motion of a body to which it is applied.

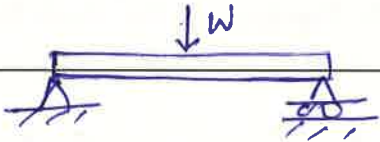
↳ 1) Magnitude

2) Direction of Application

3) Point of Application.

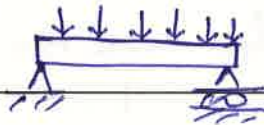
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Concentrated force / Point load



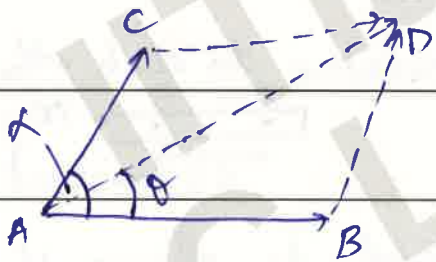
$w/\text{length}$ .

Distributed force:-



Parallelogram law of Vectors:-

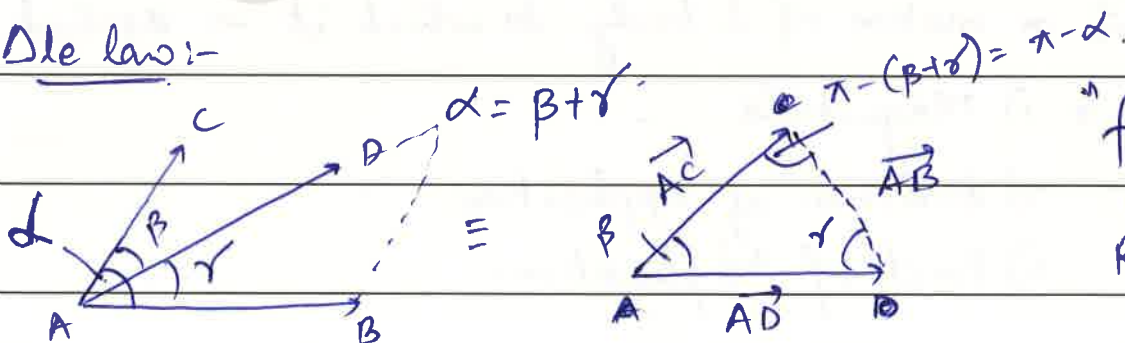
If two forces (or Vectors) represented by vector  $AB$  &  $AC$  acting under an angle are applied to a body at point  $A$ . Their resultant can be written as:-



$$AD = \sqrt{AB^2 + AC^2 + 2AB \times AC \cos \alpha}$$

$$\theta = \tan^{-1} \left( \frac{AC \sin \alpha}{AB + AC \cos \alpha} \right)$$

Sine law:-

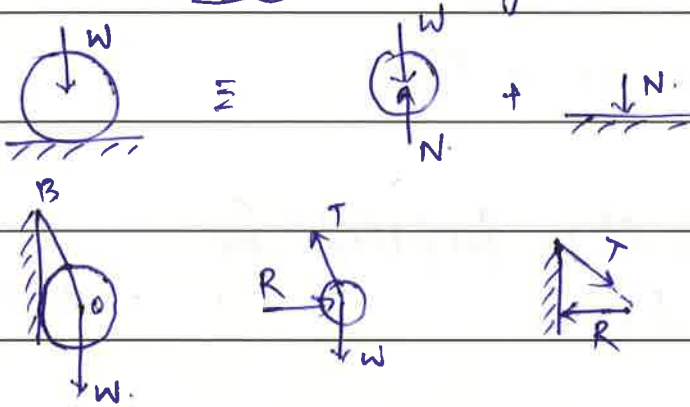


from here also, direction of Resultant can be calculated."

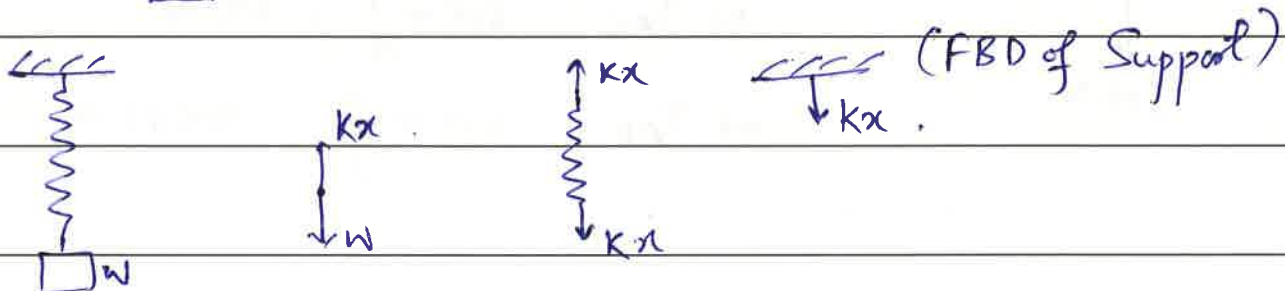
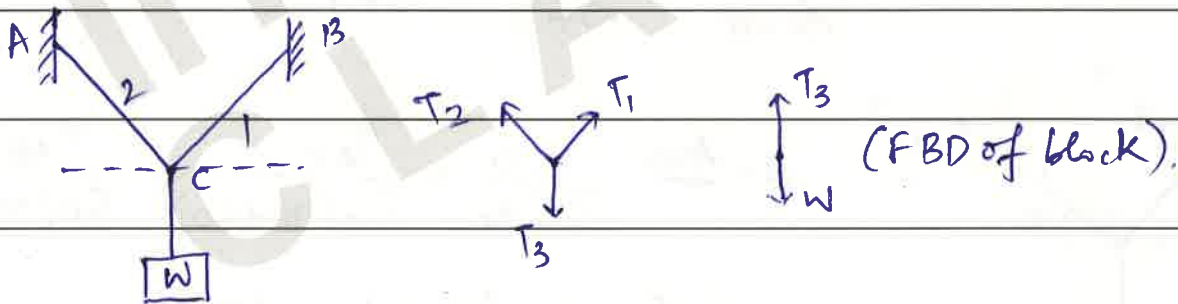
$$\frac{\vec{AC}}{\sin \gamma} = \frac{\vec{AB}}{\sin \beta} = \frac{\vec{AD}}{\sin(\pi - \alpha)}$$

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Action and Reaction:- Always Acts <sup>two</sup> off on <sub>n</sub> different bodies.



Free body Diagram:- It is necessary to investigate the condition of equilibrium of a body or system. While drawing the free body diagram, all the supports of the body are removed and replaced with the Reaction forces acting on it.



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## Equilibrium of Coplanar Forces:-

→ Forces in a Plane.

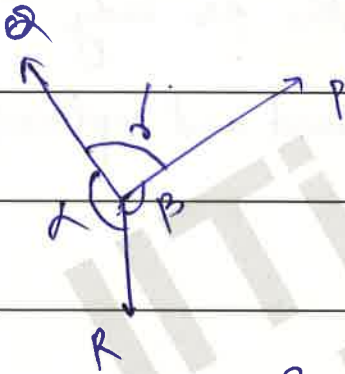
$$\sum F_x = 0$$

$$\sum F_y = 0$$

$$\sum M = 0$$

Conditions should be fulfilled for equilibrium.

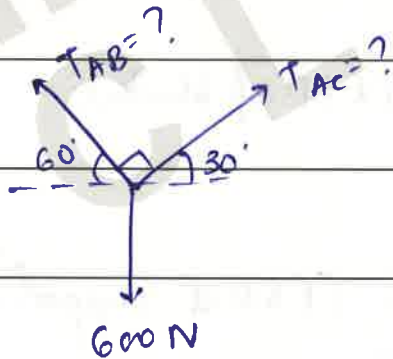
Lami's theorem:- (for 3-vectors).  $\approx$  Sine law.



If three forces are acting at a point in equilibrium, then.

$$\frac{P}{\sin \alpha} = \frac{Q}{\sin \beta} = \frac{R}{\sin \gamma}$$

Q. GATE-2006



Q. Ans.  $\frac{600}{\sin 90^\circ} = \frac{T_{AC}}{\sin(90+60)} = \frac{T_{AB}}{\sin(90+30)}$

$$\Rightarrow T_{AC} = 600 \times \frac{1}{2} = 300 \text{ N.}$$

$$\Rightarrow T_{AB} = 600 \times \frac{\sqrt{3}}{2} = 300\sqrt{3} \text{ N.}$$