Unit-5

Friction

When one body slides over another body a Resistance force is developed by the contact surfaces which opposes the motion called friction force.

Types of friction:

1. Dry friction
   - Static friction
   - Dynamic friction
     - sliding friction
     - Rolling friction

Limiting friction

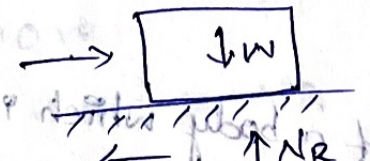
The max resistance offered by the body is called "limiting friction".

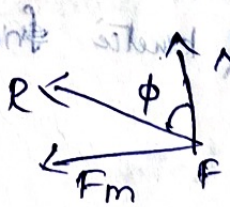
Co-efficient of friction:

It is the ratio of limiting friction ato Normal reaction is known co-eff of friction.

$$\mu = \frac{F_m}{N_R}$$

Angle of friction:





$$R = \sqrt{N_R^2 + F_m^2}$$

the angle b/w the resultant 'R' and the normal reaction NR is called angle of friction.

$$\tan\phi = \frac{F_M}{N_R}$$

$$\tan\phi = \mu$$

$$\mu = \frac{F_M}{N_R} \qquad F_m = M \times N_R$$

$$F_{ms} = M_s \cdot N_R$$

$$F_{mk} = M_k \cdot N_R$$

Laws of dry friction: law of dry friction.

① Static friction:

i) The frictional force always acts in the opposite direction to meets the body tends mov

ii) frictional force does not depend on the shape and area of contact of the bodies.

iii) The frictional force depends on the degree of _____ of the contact area b/w two bodies.

iv) The frictional force ~~depends on the degree of~~ is equal to the force applied to the body, so long as the body is at rest.

v) $F_m \propto N_R$

$F_m = \mu_s \cdot N_R$.

2) laws of Dynamic friction:

i) The frictional force acts in the opposite direction to that body moves.

ii) The magnitude of dynamic friction bears a constant ratio to the normal reaction b/w two surfaces.

iii) Coefficient of kinetic friction is less than the co-effic of static friction.

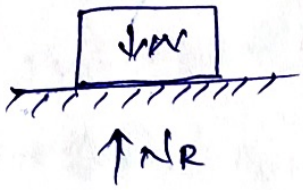
Impending motion:

The state of motion of a body which is just about to move (or) slide is called impending motion of the body.

Contact surfaces	Range of μ_s
Wood on wood	0.2 - 0.6
Leather on wood	0.2 - 0.5
Metal on ice	0.03 - 0.05
Leather on metal	0.3 - 0.6
Mild steel on Mild steel	0.5 - 0.6
Rubber on pavement	0.6 - 0.8

Basic Concepts:

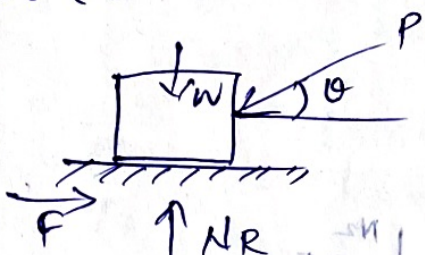
case (i) $F = 0$ Body is in the condition of equilibrium.



$\Sigma V = 0$

$N_R = W$

case (ii) $F < F_m$ Body is still in equilibrium



$\Sigma H = 0$, $F = P\cos\theta$

$\Sigma V = 0$ $N_R = W + P\sin\theta$

case (iii) $F = F_m$

When the limiting friction is attained, then the block is in impending motion, i.e. just start to move.

$F_m = \mu \cdot N_R$ is applied.

$\Sigma H = 0$ $F_m = P\cos\theta$

$N_R = W + P\sin\theta$

case (iv) $F > F_m$

$F = \mu N$ not be applied

$F = \mu_k N$ is applied.