BRAKES:-

Clutch Vs Brake:-

The functional difference between a clutch and a brake is that a clutch connects two moving members of a machine, whereas a brake connects a moving member to a stationary member. That is, if any one of the moving member of a clutch is fixed, then the device becomes a brake.

classification of Brakes:-

A classification scheme for brake is presented:-> From our subject point of view,

1) Block or shoe brake.
   i) single block brake ii) Double block brake.

2) Band brake,
   i) Simple band brake ii) Differential band brake.

3) Band and block brake

4) Internal expanding shoe brake

5) External contracting shoe brake

The Mechanical brakes, according to the direction of active force, may be divided into the following two groups.

a) **Radial brakes**:- In radial brakes, the force acts radially on the drum.
   Examples: Band brakes, block brakes, and internal expanding brakes

Axial brakes:-

In axial brakes, the force acts axially on the drum.

Examples:- cone brakes, and disc brakes.

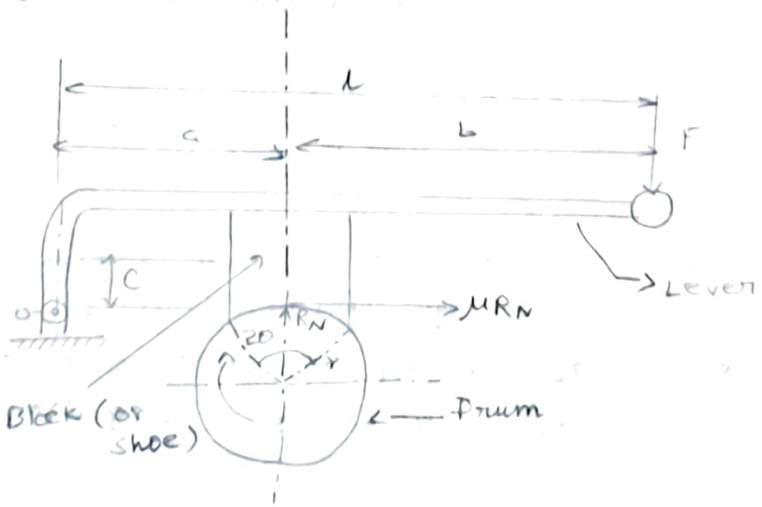
Brake Lining Materials:-

The required Qualities of a good brake lining Material are :-

* A high and uniform co-efficient of friction.
* The ability to withstand high Temperatures, together with heat high heat dissipation capacity.
* Adequate Mechanical and thermal strengths.
* High resistance to Wear.
* Resistance against environmental conditions, Suchas Moisture and oil.

Single block (or) shoe brake:-

A single block (or) shoe brake is shown in fig. The friction between the block and the brake drum causes the retarding of the drum. This type of brake is commonly used on railway trains and tram cars.



The block is Pressed against the drum by a force applied on one end of a lever. The other end of the lever is Pivoted on a fixed fulcrum

r = Radius of drum

R_N => Normal reaction of the block.

F => Force applied at lever end

μ => co-efficient of friction

μR_N => Frictional force, and

T_B => Braking Torque.

When the Rotation of the drum is clockwise..,

Fig shows the clockwise rotation of brake drum,

Braking Torque on the drum is given by .,

$$T_B = \mu R_N \cdot r.$$

Taking Moments about Pivot O,

$$F.l + \mu R_N \cdot c = R_N \cdot a$$

$$F.l - R_N \cdot a + \mu R_N \cdot c = 0.$$

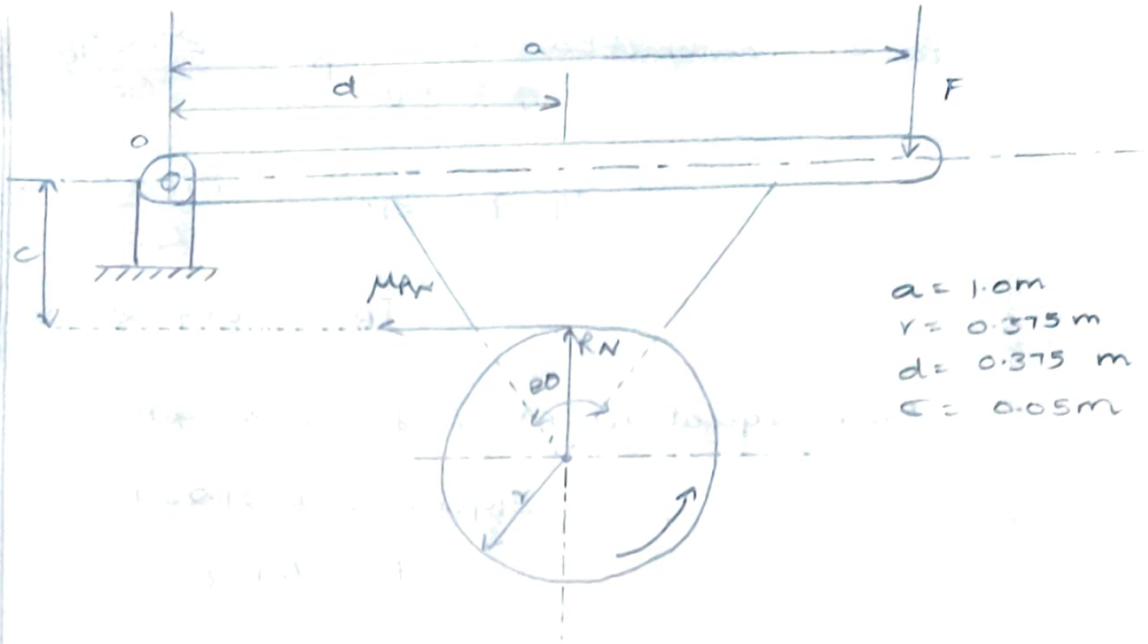
$$F => \frac{R_N (a - \mu c)}{l}$$

$$R_N = F. \frac{l}{a.\mu c.}$$

Substituting R_N Value from equation (iv) in equation (i), we have

$$T_B = \mu . \frac{F.l.r}{a - \mu c}.$$

The short shoe block brake shown in fig. For a co-efficient of friction 0.3, a frictional Power of 14.924 kW at 650 rpm. is to be absorbed. What actuating force is required? Can the brake be self-locking?



$a = 1.0m$
$r = 0.375\ m$
$d = 0.375\ m$
$c = 0.05m$

Given Data:-

$\mu = 0.3$, $P = 14.924\ KW = 14924 \times 10^3\ W$, $c = 0.05\ m$, $N = 650\ rpm$, $r = 0.375\ m$, $a = 1.0\ m$, $d = 0.375\ m$.

To find:

i) Actuating force (F) required, and
ii) checking the brake for self locking.

Solution: i) Required actuating force...,

Let R_N = Normal force Pressing the block against the wheel

μR_N => Frictional force, and

2θ => Angle of contact of the block with the wheel.

Taking Moments about fulcrum O, we have

$$R_N \cdot d = F \cdot a + \mu R_N \cdot c$$

$$R_N (d - \mu c) = F a$$

$$R_N = \frac{F \cdot a}{d - \mu c}$$

Braking Torque is given by,

$$T_B = \mu R_N \cdot r = \mu \cdot \frac{F \cdot a}{d - \mu c} \cdot r$$

$$T_B = \frac{0.3 \times F \times 1.0 \times 0.375}{0.375 - 0.3 \times 0.05}$$

$$T_B = 0.3125\ F.$$

the

Power Transmitted is given by, $P = \frac{2\pi N T_D}{60}$

$$14.924 \times 10^3 = \frac{2\pi \times 650 \times T_D}{60}$$

$$T_B = 219.25 \text{ N-m}$$

From equations i) and iii) we get...,

$$219.25 = 0.3125 F$$

$$F = 701.6 \text{ N}$$

ii) Self locking condition:-

In equation (i) if $d \leq \mu \cdot c$, then force F will be negative (or) zero. This is the condition of self locking distance.

In this case..., $d = 0.315$ m.

$$\mu c = 0.30 \times 0.05 = 0.0015 \text{ m}$$

Here, d is not less than $\mu \cdot c$, Thus the brake cannot be self locking.