# DESIGN AND FABRICATION OF FRICTIONLESS BREAKING SYSTEM
# BACHELOR OF ENGINEERING IN MECHANICAL ENGINEERING

By

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# 1. INTRODUCTION

- Frictionless brakes rely completely on certain magnetic properties and resistance.
- Frictionless brakes are silent and are much smoother than friction brakes.
- Frictionless brakes are more efficient than normal brakes.
- It reduces the risk of accidents.

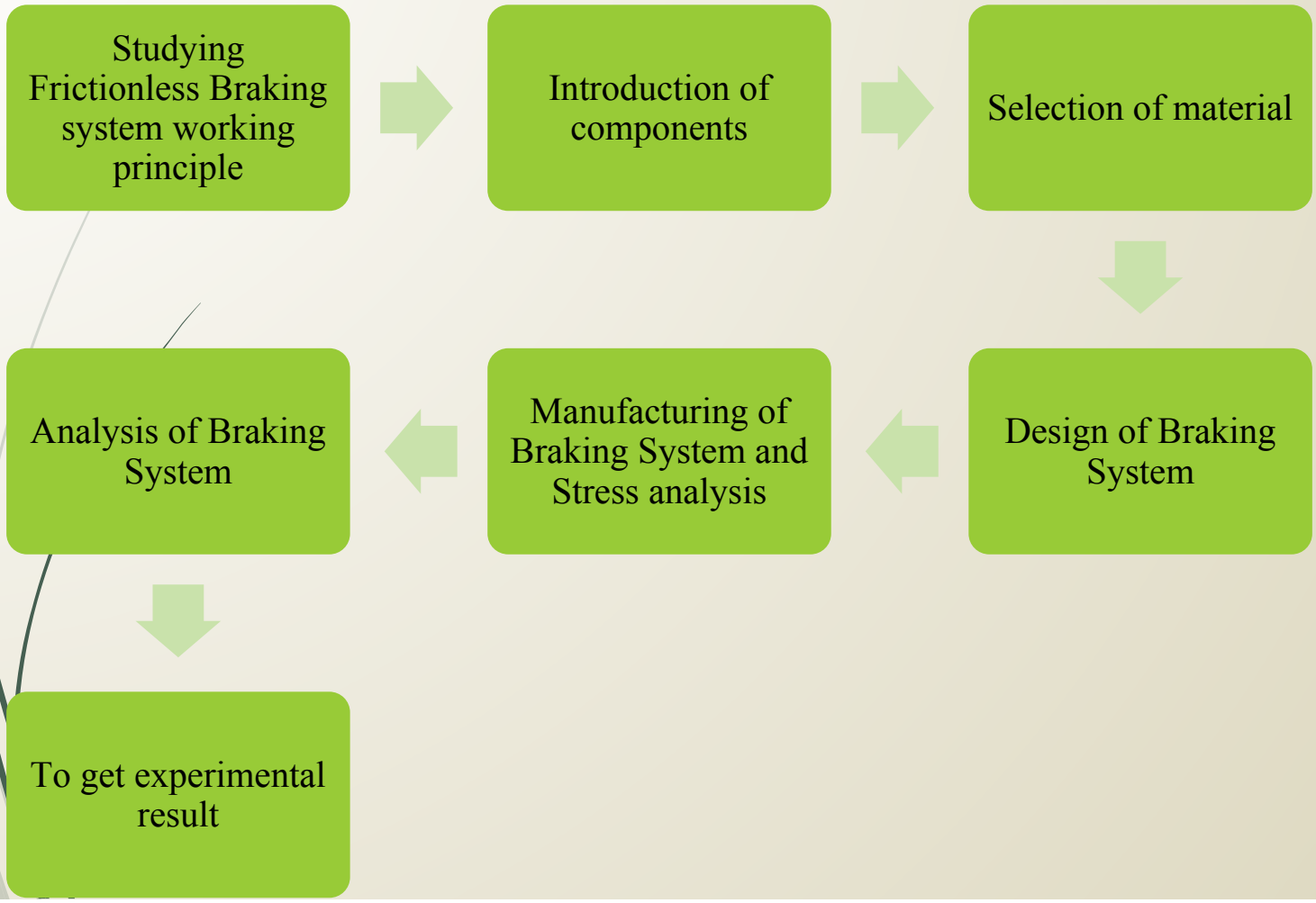
# 2. OBJECTIVE

- To design and fabricate Frictionless Braking system with greater performance replacing conventional breaking system.
- To achieve better braking efficiency.
- To increase the reliability and life span of brakes.
- To increase power to weight ratio.
- To reduce the maintenance cost.
- To analyse the stresses in braking system.

# 3.LITERATURE REVIEW

| Sr No. | Year | Author | Paper | Summary |
|---|---|---|---|---|
| 01 | 2013 | Ajay Yadav | Electromagnetic brakes in two wheelers | Electromagnetic brakes can be applicable in two wheeler at high speed with low maintenance cost. |
| 02 | 2008 | Sergey Kitanov and Anatoly Podol'skii | current and magnetic rail brakes for high speed trains | The magnetic eddy current brakes containing permanent magnet pieces offer several advantages over convention braking system |
| 03 | 2014 | Akshay kumar S. Puttewar, Nagnath U. Kakade | Electromagnetic brakes in automobile | In electromagnetic braking system even any coil fails the brake does not completely fails and remaining three coils work properly unlike oil or air braking system. This system needs very low maintenance. |

# 4.RESEARCH METHODOLOGY



# 5. ACTION PLAN

| SR NO | PROJECT ACTIVITIES | STAT DATE | COMP DATE |
|---|---|---|---|
| **1** | PLANNING THE TASK | 19/8/2019 | 14/9/2019 |
| **2** | MARKET SURVEY | 4/10/2019 | 18/10/2019 |
| **3** | DESIGN & PLANNING THE FABRICATION PROCESS | 14/12/2019 | 28/12/2019 |
| **4** | PREPAIRING DRAWING AND ESTIMATION OF MATERIAL | 3/1/2020 | 17/1/2020 |
| **5** | MARKET SURVET FOR PURCHASE AND PROCURING THE MATERIAL | 30/1/2020 | 8/2/2020 |
| **6** | PLANNING AND PROCESS | 21/2/2020 | 23/2/2020 |
| **7** | MANUFACTURING THE SUBCOMONENTS | 28/2/2020 | 13/3/2020 |
| **8** | ASSEMBLY | 14/3/2020 | 15/3/2020 |
| **9** | Comparative study | 14/3/2020 | - |

# 6.EXPERIMENTATION AND ANALYSIS

## PRINCIPLE AND WORKING OF FRICTIONLESS BRAKING SYSTEM

- When an electrical conductor, such as copper or aluminium, moves through the field of a permanent magnet or an electromagnet, electromagnetic induction creates eddy currents, which dissipate some of the kinetic energy into Joule heat and results in slowing the motion of the conductor.
- This principle is utilized in the construction of magnetic brakes. This demonstration shows magnetic braking applied to a rotating metallic disc.
- In contrast to conventional friction brakes, there is no direct contact between interacting surfaces, which makes magnetic braking more reliable and reduces wear and tear.
- A magnetic brake is a device that leverages strong magnetic forces to slow a vehicle down.

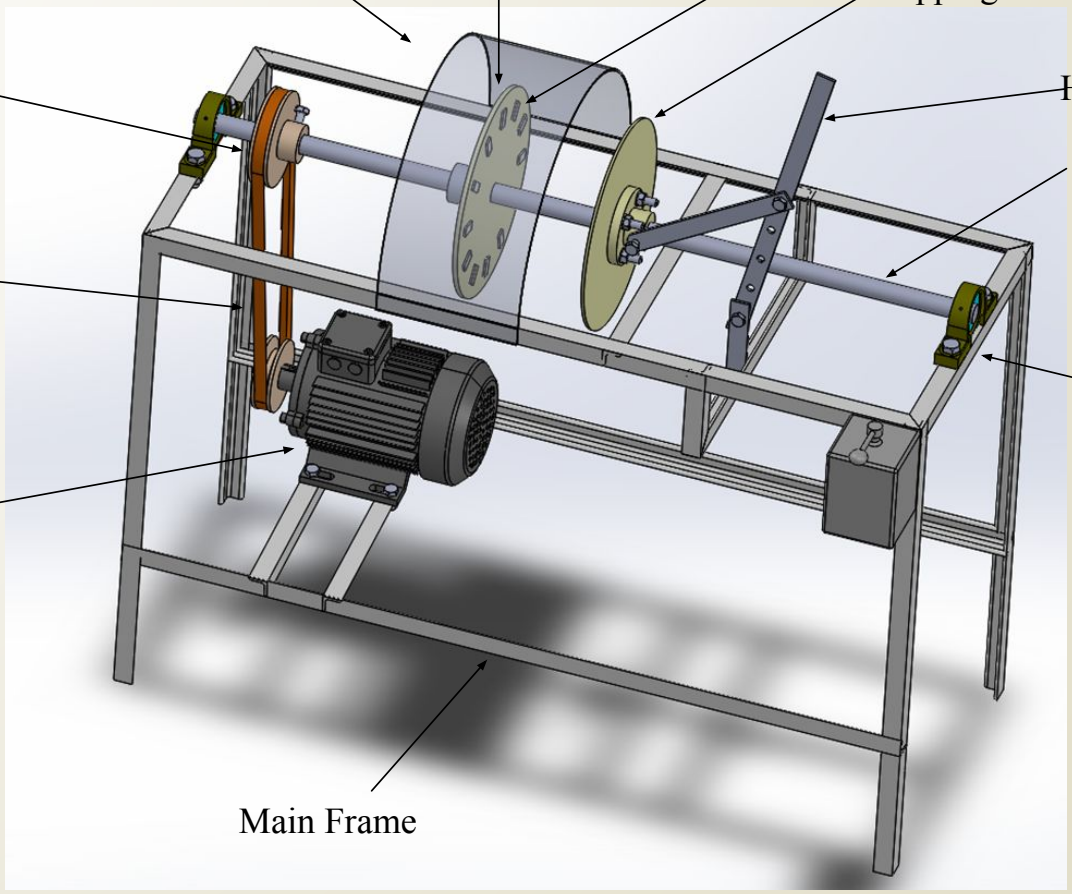



Fig (A):Frictionless braking system

# 7. MATERIAL USED

Table of Raw Material & Standard Material

| SR NO | PART NAME | MAT | QTY |
|---|---|---|---|
| 1 | Frame | MS | 1 Nos |
| 2 | Magnet | Neodymium | 12 Nos |
| 3 | Shaft  Dia 20 mm | EN 8 | 1 Nos |
| 4 | 0.5 Hp 3 Phase Ac Motor 1380 | STD | 1 Nos |
| 5 | Pulley | MS | 2 Nos |
| 6 | Flywheel | STD | 1 Nos |
| 7 | Aluminium Wheel | Al | 1 Nos |
| 8 | Pedestal Bearing | CI | 2 Nos |
| 9 | Free Wheel | STD | 1 Nos |

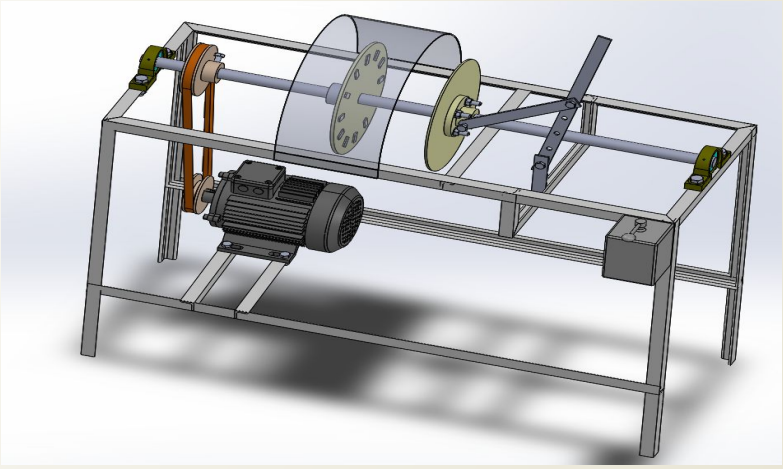
# 7. FABRICATION

Before doing the fabrication of actual model, we consider the following parameters for our calculations.

1)Name of Bike = Honda Shine

## 7.1 Design specification for Frictionless Braking System :

| Sr No. | Design Part | Specification |
|---|---|---|
| 1 | Motor | 0.5 Hp, 1380 rpm |
| 2 | Pulley-1 | 100 mm |
| 3 | Pulley-2 | 75 mm |
| 4 | V Belt (L) | 37 inch |
| 5 | Shaft (D) | 20 mm |
| 6 | Bearing | P204 |
| 7 | Bolt (D) | 8 mm |
| 8 | Stand Angle (L Shaped) | 20*20*4 |



Fig(B):CAD model of Frictionless Braking System

Fig(C):Project in making

Fig(D):finished model of frictionless brake

## 7.2 Braking Time Calculation For Disc Brake:

1) The braking process starts with the application of force on the brake pedal with leverage and fluid in the master cylinder gets pressurized.

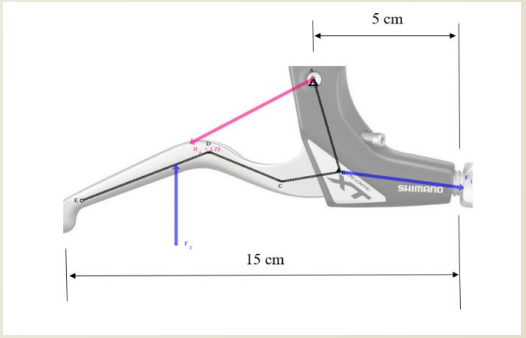
Hence,

$$P_e = \frac{Pedal\ force * leverage}{Master\ cylinder\ area}$$

$$= \frac{392 * 3}{\frac{\pi}{4} * (0.1905)^2}$$

$$= 4.126 * 10^6\ N/m^2$$

Fig(1)




Fig(2)

2) Friction force on disc,

$$F_e = \mu * P_e * 2 * \text{area of caliper cylinder}$$

$$= 0.3 * 4.126 * 10^6 * \frac{\pi}{4} * (0.032)^2$$

$$= 1990.995\ \text{N}$$

$$\approx 1991\ \text{N}$$

3) The friction force provides braking torque to wheel and then this braking torque is converted into the braking force which can be calculated by the following equation. Brake force by each disc,

$$F_d = \frac{F_e * R_e}{R_w}$$
$$= \frac{1991 * 0.11}{\frac{0.508}{2}}$$
$$= 862.244 \text{ N}$$

4) In addition to the braking force exerted by braking system addition rolling friction also acts against the motion of the vehicle.
Rolling friction force,

$$F_{f_r} = \mu_r * m * g$$
$$= 0.04 * 325 * 9.81$$
$$= 127.53 \text{ N}$$

5) Now total braking force is the summation of forces exerted on disc brakes and rolling friction. Hence, total force,

$$F_t = F_{fr} + F_d$$
$$= 127.53 + 862.244$$
$$= 989.774 \text{ N}$$
$$\approx 990 \text{ N}$$

6) Now, for the Braking Time calculation we take,
speed of bike = 11.944 m/s

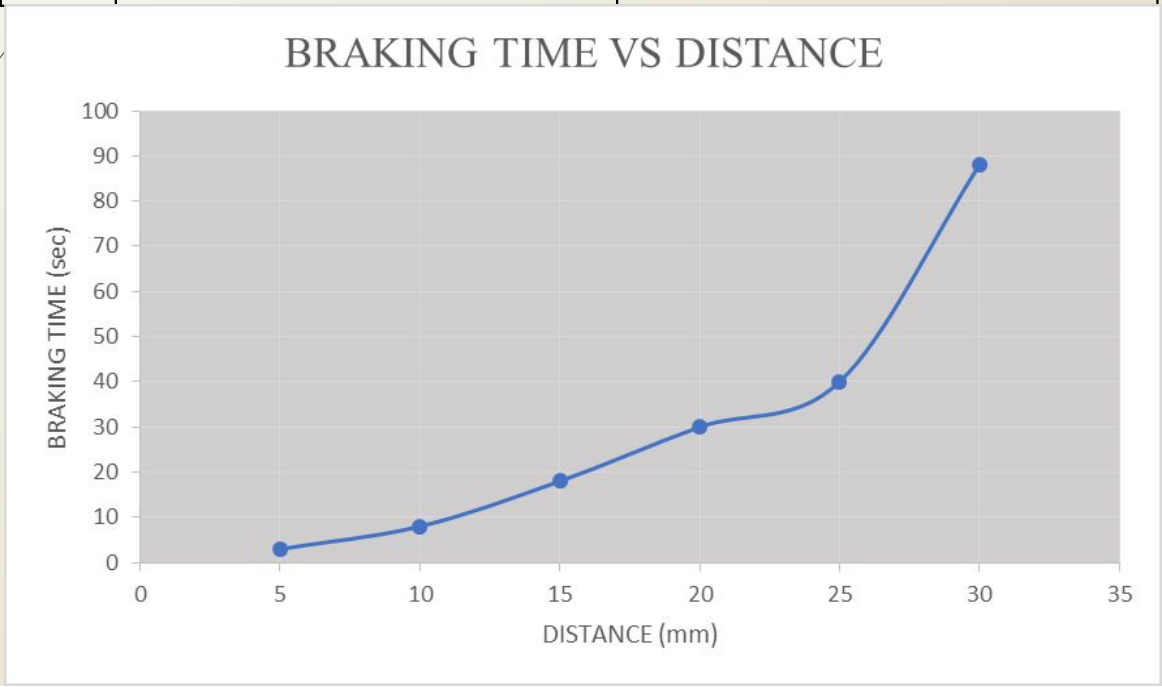
$$F = m * a$$
$$990 = 325 * a$$
$$a = 3.0461 \text{ m/}s^2$$

&

$$a = \frac{v}{t}$$
$$t = \frac{v}{a}$$
$$t = \frac{11.944}{3.046}$$
$$t = 3.921 \text{ sec}$$

# 8.OBSERVATION

| Sr No. | DISTANCE (mm) | BRAKING TIME (sec) |
|---|---|---|
| 1 | 30 | 88 |
| 2 | 25 | 40 |
| 3 | 20 | 30 |
| 4 | 15 | 18 |
| 5 | 10 | 8 |
| 6 | 5 | 3 |



# 9. VALIDATION OF RESULTS

| Sr No | Type Of Brake | Theoretical Braking Time (Sec) | Practical Braking Time (Sec) |
|---|---|---|---|
| 1 | Disc Brake | 3.921 | 4.5 |
| 2 | Frictionless Brake | - | 3 (For 5mm) |

# 10. RESULTS

- Braking efficiency  increases.
- Stopping time of vehicle decreases.
- Power consumption of vehicle reduces.
- Wear and tear of brake is zero.
- High Braking effect is obtained at minimum distance between magnet and stopping plate.

# 11.CONCLUSION

- Frictionless Braking System found to be more reliable compared to other braking system.
- This system required very less maintenance.
- It is an abrasion free method.
- Frictionless brake increases the safety and reduces the risk of accident.
- Overall cost of Frictionless Braking System is lesser than others.

# 12.LIMITATIONS

- The installation of an frictionless brake is difficult.
- Complexity is higher than conventional brakes.
- All magnets have a sudden curie point ,a temperature at which they lose their magnetism. This is very bad for braking action.
- Neodymium magnets get corroded after some time.
- Installation cost is high.

# 13.FUTURE SCOPE

- Frictionless brakes satisfy all the energy requirements of braking without use of friction.
- With the help of frictionless braking system, the braking time is reduced.
- They can be also used as a supplementary retardation equipment in addition to the regular friction brakes in heavy vehicles.
- The overall cost is less.
- With the use of this technology noise will be reduced.
- This can be used as an alternative method for the future crisis of oil.

# 14. REFERENCE


1) Ajay Yadav, “Electronic Motor Braking,” IEEE Trans. On Industry Applications, vol.IA-19,pp.824-831,Apr.1983.

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# THANK YOU !!!!