

# K J Somaiya College of Engineering, Mumbai-77

(Somaiya Vidyavihar University)

Batch: D2      Roll No.:16010221025  
Experiment / assignment / tutorial No. 4  
Grade: AA / AB / BB / BC / CC / CD / DD  
Signature of the Staff In-charge with date

## Title - Friction

CO1: Identify the effect of forces and moment in a given engineering system

CO3: Analyze applications of equilibrium using free body diagram

### Objective

To measure coefficient of friction of different surfaces

### Theory

Friction is a force that is created whenever two surfaces move or try to move across each other. •

Friction always opposes the motion or attempted motion of one surface across another surface.

- Friction is dependent on the texture of both surfaces.
- Friction is also dependent on the amount of contact force pushing the two surfaces together

Static friction is friction between two or more solid objects that are not moving relative to each other. For example, static friction can prevent an object from sliding down a sloped surface. The coefficient of static friction, typically denoted as  $\mu_s$ , is usually higher than the coefficient of kinetic friction.

### AIM:

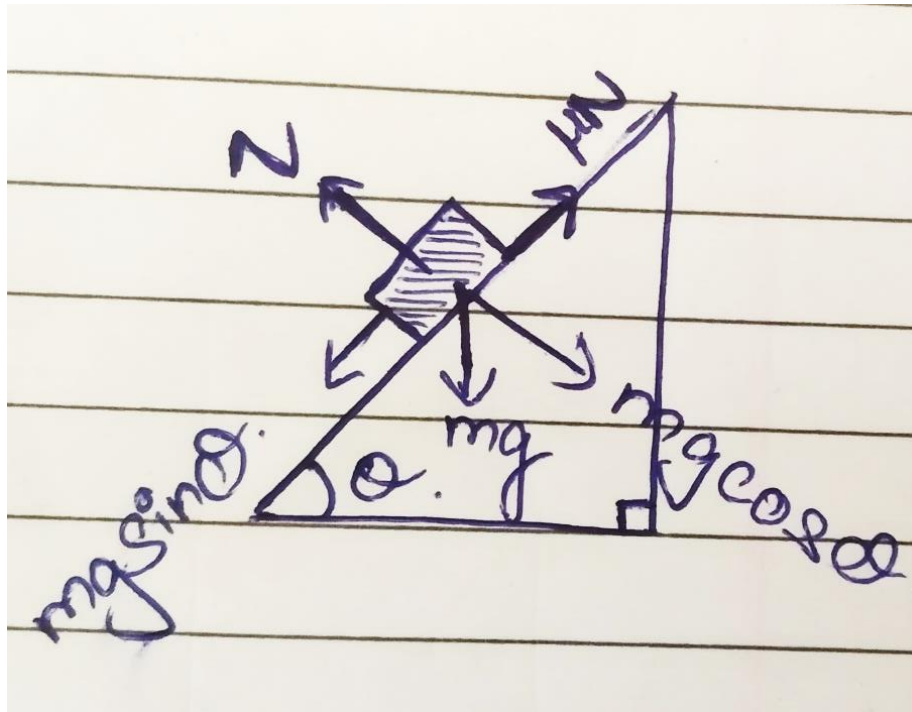
To find the coefficient of friction between two given surfaces and to find the load required to pull a body up on an inclined plane.

### APPARATUS:

An inclined plane that can be set at different angles, bodies with different base materials and weights.

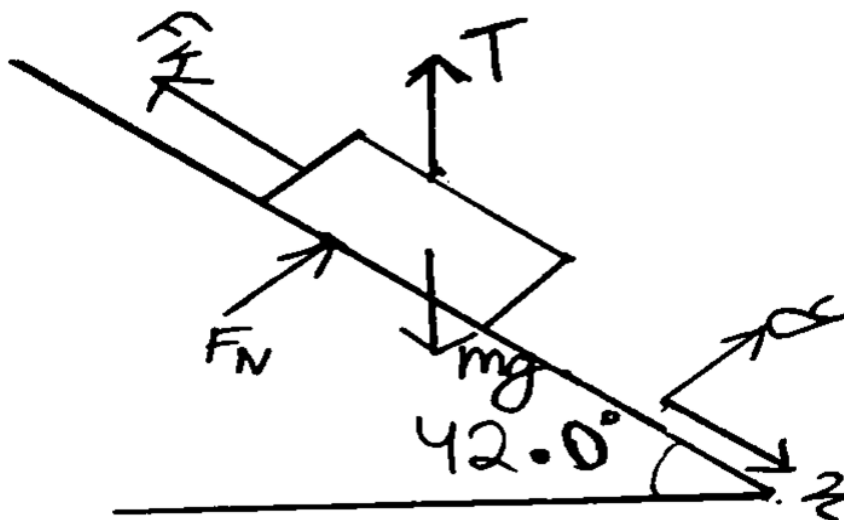
### **Setup Diagram:**

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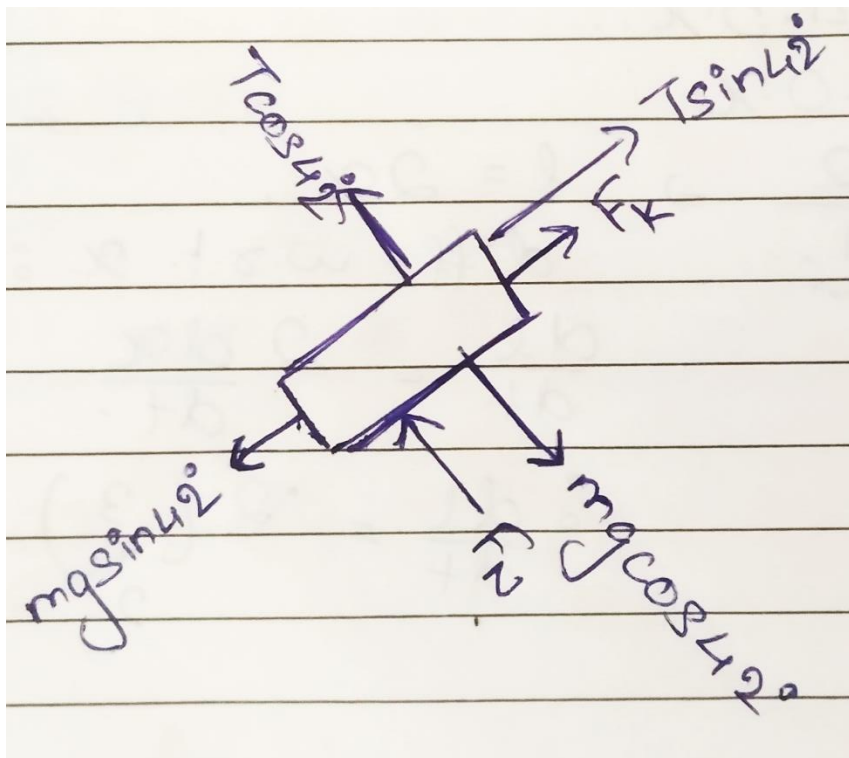


FREE BODY DIAGRAM

For Angle of Repose



**For Experimental value of P**



## **PROCEDURE:**

### **Observation 1:**

1. Keep the body on the inclined plane which is initially at the horizontal position.
2. Gradually increase the angle made by the inclined plane till the body just start sliding down.
3. Note the angle made by the inclined plane with horizontal which is angle of repose 4. Tangent of the angle of repose is the coefficient of friction between the two materials (body and the plane).

### **Observation 2:**

5. Set the inclined plane at any angle. Attach the string to the body whose weight is known.
6. Place the body on the inclined plane and pass the string over the pulley.
7. Load the free end of the string with the pan and the weights.
8. Add weights to the pan till the body is tending to move up. Note the load and compare it with the calculated value.

## **OBSERVATION TABLE 1**

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Materials	Angle of Repose ( $\alpha$ )				Coefficient of friction ( $\mu$ )
	1	2	3	mean	
Ply and wood	12°	11°	13°	12°	0.21
Ply and aluminium	20°	23°	24°	22.33°	0.41
Ply and brass	19°	20°	20°	19.66°	0.35
Ply and sand paper	10°	10°	10°	10°	0.17

## OBSERVATION TABLE 2

Surfaces	Coefficient of friction	Weight (W)	Angle of plane ( $\theta$ )	$P_{th} = W \sin \theta + \mu W \cos \theta$	P(expt.)
Ply and wood	0.21	250g	25°	152.52	143.48
Ply and aluminium	0.41	167g	25°	131.76	118.48
Ply and brass	0.35	288g	25°	211.68	196.48
Ply and sand paper	0.17	162g	25°	92.82	94.48

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### CALCULATION:

\* Calculations:

⇒ Angle of repose:

Ply & Wood      mean =  $\frac{12+11+13}{2} = \underline{12^\circ}$

Ply & Aluminium      mean =  $\frac{20+23+24}{3} = \underline{22.33^\circ}$

Ply & Brass      mean =  $\frac{19+20+20}{3} = \underline{19.66^\circ}$

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⇒ Coeff. of friction: ( $\mu$ )

$\tan \theta = \mu$

Ply & Wood :  $\tan(12^\circ) = \underline{0.21 = \mu}$

Ply & Aluminium :  $\tan(22.33^\circ) = \underline{0.41 = \mu}$

Ply & Brass :  $\tan(19.66^\circ) = \underline{0.35 = \mu}$

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⇒  $P_{th} = W \sin \theta + \mu W \cos \theta$

Ply & Wood :  $P_{th} = W \sin \theta + \mu W \cos \theta$

                    =  $250 \sin 25^\circ + 0.21 \times 250 \times \cos 25^\circ$

                    =  $\underline{152.52}$

Ply & aluminium =  $167 \times \sin 25^\circ + 0.43 \times 167 \times \cos 25^\circ$

                    =  $\underline{131.76}$

### RESULT

Coefficient of Friction for:

Ply and wood : 0.21

Ply and aluminium : 0.41

Ply and Brass : 0.35

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Ply and Sand Paper : 0.17

**Conclusion:**

The experiment was taken under good circumstances. However, errors can be reduced by overlapping the mistake that was take place in this experiment. This experiment could be done exactly the same as international standard if the following conditions apply on it. First of all make sure that the hanging masses do not move while adding additional weight on load hanger. This experiment will be really useful in the future to determine the coefficient of friction for different materials.

**Signature of faculty in-charge**