K J Somaiya College of Engineering **(A Constituent College of Somaiya Vidyavihar University)**

Batch: Roll No.:
Experiment / assignment / tutorial No.
Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Title: Coplanar Concurrent Force System

CO1 Evaluate resultant and moment of a force system

Objective

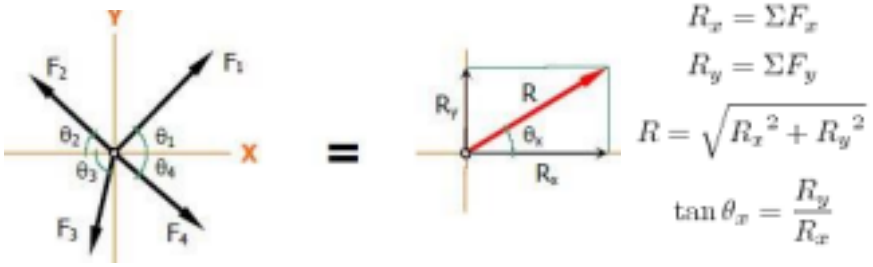
To verify the condition of equilibrium of a coplanar concurrent forces .

Theory

Resultant of a force system is a force or a couple that will have the same effect to the body, both in translation and rotation, if all the forces are removed and replaced by the resultant.

Resultant of Coplanar Concurrent Force System

The lines of action of each force in coplanar concurrent force system are on the same plane. All of these forces meet at a common point, thus concurrent. In x-y plane, the resultant can be found by the following formulas:



$$R_x = \Sigma F_x$$
$$R_y = \Sigma F_y$$
$$R = \sqrt{{R_x}^2 + {R_y}^2}$$
$$\tan\theta_x = \frac{R_y}{R_x}$$

AIM:

To verify the condition of equilibrium of a coplanar concurrent force system and to analyze the error if any.

APPARATUS:

Universal force table, weights.

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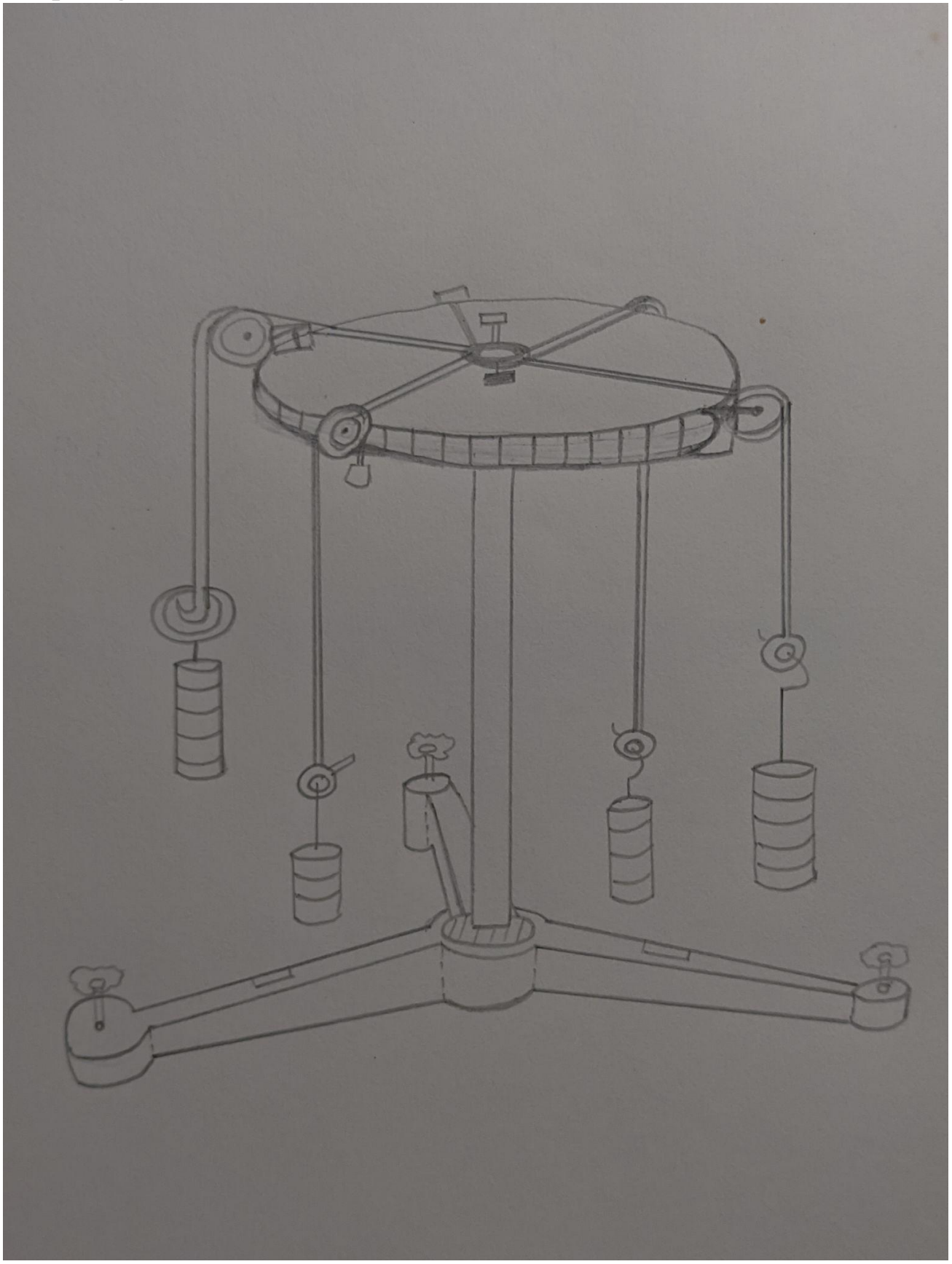
Setup Diagram:



PROCEDURE:

1. Place the Universal force table on the firm platform.

2. Make the circular disc in horizontal position with the help of foot screws. 3. Put slotted weights to each hanger to these ends of strings passing over the pulleys. 4. Note the sum of slotted weights in each hanger and weight of hangers as five forces F_1, F_2, F_3, F_4 and F_5.

5. Measure the angles included between the two adjacent pulleys and note them as Θ_1 to Θ_5.
6. Record these observations.

7. Repeat by changing any one or two pulley positions and take three sets of readings. 8. Draw force polygon.

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OBSERVATION TABLE:

Sr No	Forces					Angles					ΣFx	ΣFy
	F_1	F_2	F_3	F_4	F_5	Θ_1	Θ_2	Θ_3	Θ_4	Θ_5		
1	2.37 N	2.37 N	1.96 N	4.41 N	4.90 N	0°	68°	105°	172°	287°	-0.18	0.017
2												
3												

CALCULATION:

ΣFx = ΣFicosθi = 2.37cos(0°)+2.37cos(68°)+1.96cos(105°)+4.41cos(172°)+4.90cos(287°)
=-0.18

ΣFy = ΣFisinθi = 2.37sin(0°)+2.37sin(68°)+1.96sin(105°)+4.41sin(172°)+4.90sin(287°)
=0.017

Resultant = √ (ΣFx)^2+(ΣFy)^2
=√ (-0.18)^2+(0.017)^2
=0.1808

≈0.2

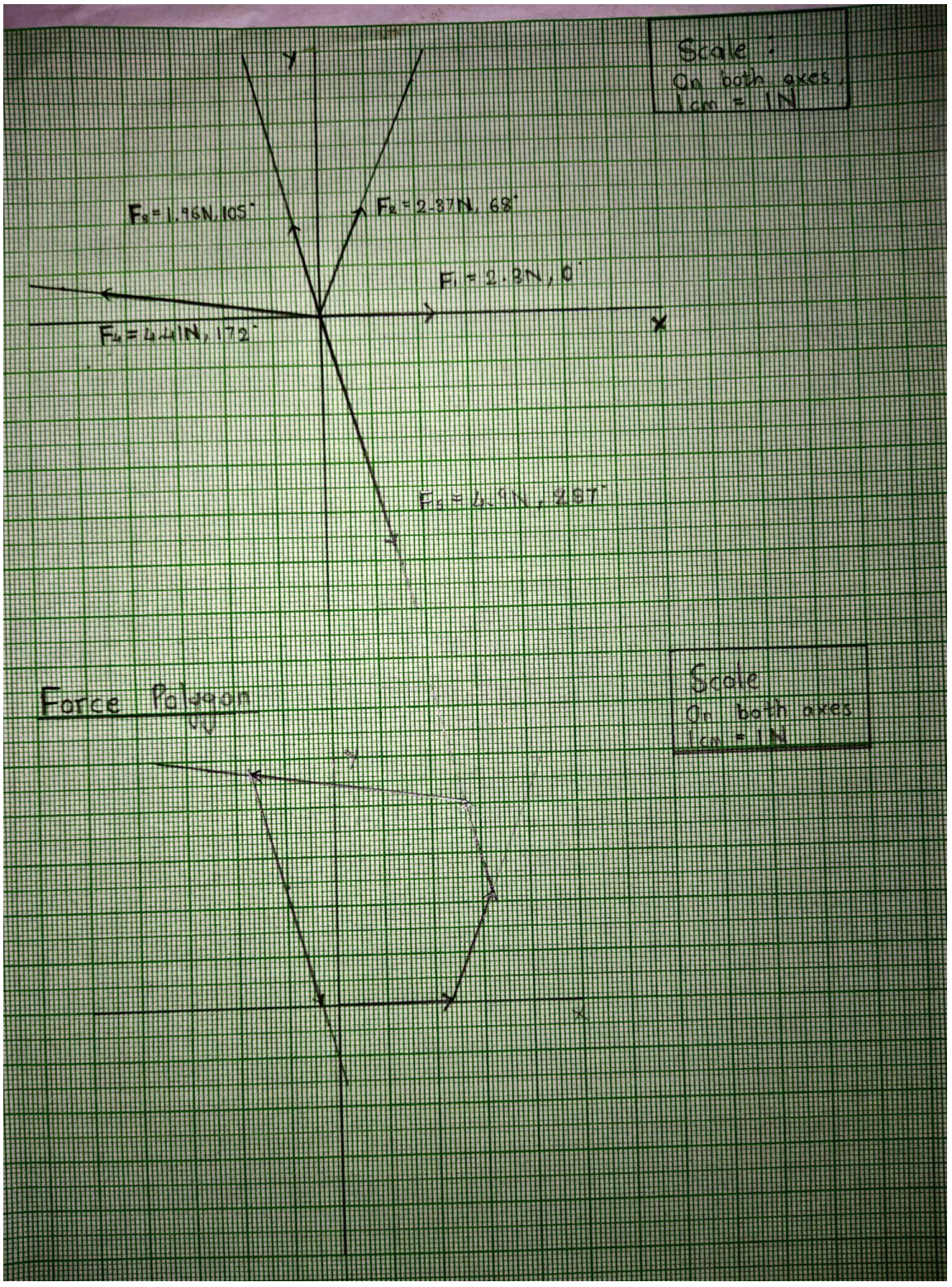
tan θ=ΣFy/ΣFx
θ = tan^-1(ΣFy/ΣFx)
=tan^-1(0.017/(-0.18))
=-5.39

RESULT:

Summation of forces in X-direction = -0.18

Summation of forces in Y-direction = 0.017

GRAPH:



CONCLUSION:

Therefore , the condition of equilibrium of a coplanar concurrent forces is verified.

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