Practical No. 11: Verify the Lamis theorem using Universal force table apparatus for given forces.

I. **Practical Significance**

Lami's theorem relates the magnitudes of coplanar, concurrent and non-collinear forces that maintain an object in static equilibrium. The theorem is very useful in analyzing most of the mechanical as well as structural systems.

Lami's theorem has been obtained from the Sine Rule for triangles. By representing the forces as lines as in a free-body diagram and translating them in such a way that one head touches the tail of another, then it will be noticed that when there are three forces, if they are supposed to cancel each other, they resultantly form a triangle. If they are not supposed to cancel each other, they form an open curve. The Sine Rule is only applicable for triangles only and hence Lami's Theorem is only applicable to three forces, but not for the 'n' number of forces.

II. **Industry/Employer Expected Outcomes**

After Studying this Practical Students will be able to find tension in string in three coplanar, concurrent forces.

III. **Course Level Learning Outcome(s)**

CO3 - Determine unknown force(s) of given load combinations in the given situation.

IV. **Laboratory Learning Outcome(s)**

Analyse the resultant force of given force system.

V. **Relevant Affective Domain related Outcome(s)**

a. Follow safety practices and precautions.
b. Demonstrate working as a leader/a team member.
c. Maintain tools and equipment.

VI. **Relevant Theoretical Background**

If three coplanar forces acting at a point are in equilibrium then each force is directly proportional to the Sin of the angle included between the other two forces. By using simple weights, pulleys & strings placed around a circular table, several forces can be applied to an object located in the centre of the table in such a way that the forces exactly cancel each other, leaving the objects in equilibrium (the object will appear to be at rest). Force table and Newton's First Law is used to study the components at the force vector.

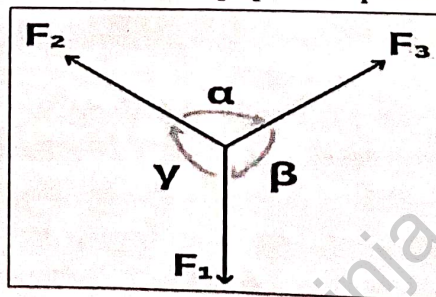VII. **Actual diagram used in laboratory with equipment specifications.**

Fig.11.1 Lamis Theorem

7. Put slotted weights to each hanger so as to make pivot and ring concentric with each other.
8. Note the sum of slotted weights in each hanger and weight of hanger as three forces F1, F2, F3.
9. Measure the angles included between the two adjacent pulleys and note them as θ1, θ2, θ3.
10. Record these observations in table.
11. Repeat step (7) by changing one or two pulleys position and take two sets of observation.

XI. Observations Table

Sr. No.	Force(N)			Angle(Degree)			Ratio		
	P	Q	R	α	B	γ	P/sin α	Q/sin β	R/sin γ
1	17.63	101.64	100	170	90	100	101.52	101.54	101.54
2	23.33	15.23	30	130	150	80	30.45	30.46	90.46
3	19.36	48.97	20	120	160	86	58.18	128.55	20.30
4	100	173.20	200	150	120	90	200	199.99	200

XII. Results

1. Ratios P/sin α, Q/sin β, R/sin γ are...Equal nearly...(Equal/Nearly equal/Not equal).

XIII. Interpretation of results

If the ratio of force to the sin of opposite angle remains constant then the third observed equilibrant force is correct.

XIV. Conclusions and Recommendations

Only three concurrent forces acting on body then the body is in equillibrium then lamis therom can be applied.

XV. Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define Lamis theorem.
2. Give the Practical Example where Lamis theorem is used.
3. State limitations of Lamis theorem.

Space for answers

Q. 1

Ans:- then should be three forces acting on a body. there three forces should be concurrent.

Q. 2 ——→ ?

Ans:- it can not be used for more than or less than three concurrent force.

Q. 4 ——→ ?

Ans:- Rope when problem heavy sphare it can place.

XVI. References/Suggestions for further Reading

Sr. No.	Link	Description
1	https://youtu.be/qYhhWHIIkLY?si=OvTv02X9NYIV1xOd	Application of Lamis theorem
2	https://www.bing.com/images/blob?bcid=rzZklUgVzq4GvA	Lamis Theorem Image
3	https://www.bing.com/images/blob?bcid=rzUEHZE3W64GdQ	Universal Force Table Image