Experiment No. : 3

Title of Experiment : Determination of Support Reactions for Beam

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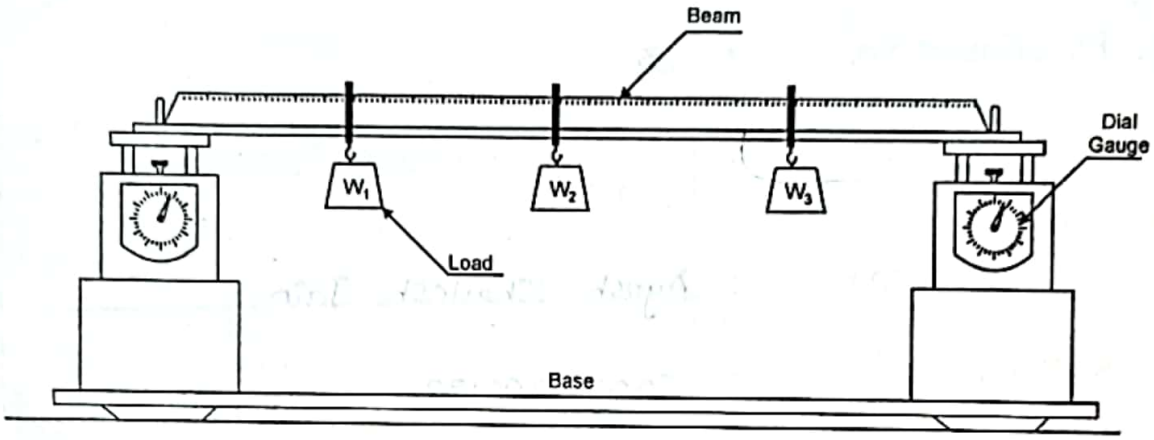
Semester : 1

Academic Year : 2020 - 2021

Punctuality	Reading & Understanding	Application	Total	Signature & Date
02	04	04	10	

DJ19FEC104.01	*Illustrate the effect of force and moment and apply the same along with the concept of equilibrium systems with the help of FBD.*
DJ19FEC104.02	*Demonstrate the understanding of Centroid and its significance and locate the same.*
DJ19FEC104.03	*Correlate real life application to specific type of friction and estimate required force to overcome friction.*
DJ19FEC104.04	*Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation.*
DJ19FEC104.05	*Analyze general plane motion of rigid bodies using Instantaneous centre.*
DJ19FEC104.06	*Analyze particles in motion using force and acceleration, work-energy and impulse-momentum principles.*

Set-up Diagram



SIMPLY SUPPORTED BEAM APPARATUS

Experiment No: 3 **Date:** 25/03/2021

Title : **Determination of Support Reactions for Beam**

Aim: To find the reactions at the supports of a simply supported beam and compare the results found experimentally with analytical values.

Apparatus :

Simply supported beam setup, hangers, loads.

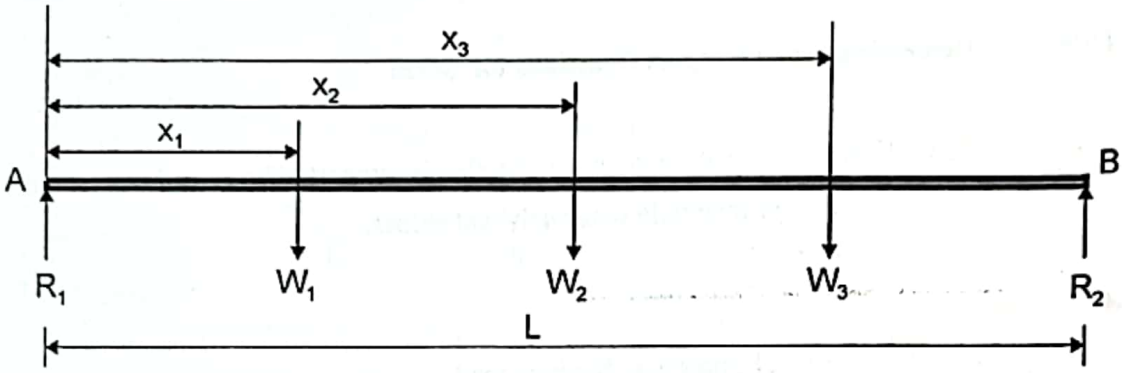
Theory :

Beam is a structural member usually horizontal and straight provided to carry loads that are vertical or inclined to its axis.

A simply supported beam is one whose ends are resting freely on the supports that provide only vertical reactions. Simply supported beam becomes unstable if it is subjected to oblique or inclined loads.

When simply supported beam is subjected to only vertical loads, its FBD forms a system of parallel forces in equilibrium. Conditions of equilibrium $\Sigma F_y = 0$ and $\Sigma M = 0$ can be applied to determine the support reactions analytically.

Free Body Diagram



Observation Table:

SR NO	X_1 (m)	X_2 (m)	X_3 (m)	W_1 (N)	W_2 (N)	W_3 (m)	Observed Reactions		Analytical Reactions	
							R_1 (N)	R_2 (N)	R_1 (N)	R_2 (N)
1	0.2	0.4	0.65	9.92	21.32	9.88	23.5	17.0	24.2	16.934
2	0.2	0.4	0.6	10.22	9.92	9.88	17.5	12	18.08	11.94
3	0.25	0.5	0.75	10.22	9.5	9.92	14.5	15.5	14.89	14.74

Procedure:

1. Place the beam of length L on simple supports. Note that below both the simple supports there is a spring arrangement. On loading, the spring compresses due to the reaction force and this compressive force is indicated on the dial.
2. Arrange the load hangers arbitrarily on the beam and set the left and right dial pointers to zero. This will nullify the effect due to self weight of the beam and the hangers.
3. Suspend the loads from the hangers. Note the load values W_1, W_2, and so on and their distances X_1, X_2 and so on from the left support.
4. Note the left and right support dial readings.
5. Repeat the above steps 1 to 4 by changing the weights in the hangers and also the hanger position for two more sets of observations.
6. Compare the experimental values with analytical values obtained by applying Conditions of Equilibrium

Calculations:

Applying Conditions of Equilibrium

$$\Sigma M_A = 0 \quad \circlearrowleft + ve$$

$$-W_1 \times x_1 - W_2 \times x_2 - W_3 \times x_3 + R_2 \times L = 0$$

$$\therefore \quad R_2 = \frac{W_1 \times x_1 + W_2 \times x_2 + W_3 \times x_3}{L}$$

$\therefore$ R2 = 9.92 X 0.2 + 21.32 X 0.4 + 9.88 X 0.65

= 16.934 N

$$\Sigma F_y = 0 \qquad \uparrow + ve$$

$$R_1 - W_1 - W_2 - W_3 + R_2 = 0$$

$$\therefore \quad R_1 = W_1 + W_2 + W_3 - R_2$$

$R_1 = 9.92 + 21.32 + 9.88 - 16.93$

$= 24.2\ N$

Result:

The support reactions obtained experimentally are nearly equal to the analytical values. The difference is within the limits of experimental error. Hence the experiment is verified.

Precautions:

1. Do not overload the beam as it may bend.
2. After placing the beam, bring all the hangers at the centre and set the dial pointers to zero. If this is not possible then take initial reading and correct the subsequent readings.
3. Place the loads carefully in the hangers as they may slip and cause accident.