17/02/2012

EXPERIMENT NO:- 3

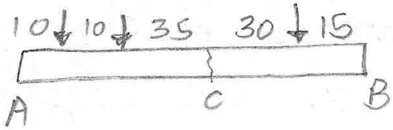
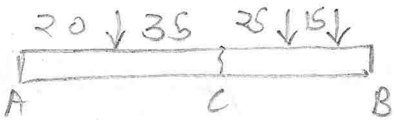
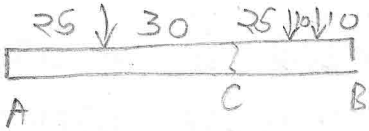
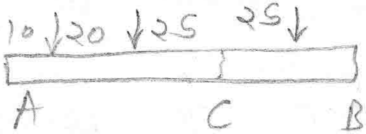
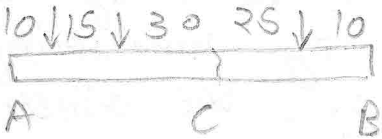
Object. To verify the theoretical bending moment by aluminium beam apparatus at the section of hinge using various load combination.

Apparatus Used:- Wooden beam apparatus, lever, slotted weights.

Theory:- The bending moment in a beam at any section is the transverse moment tending to cause bending of the beam in the plane of loading.

Experimental determination of bending moment at a cross section is made by improving a beam in two part & by measuring the reaction of one part on the other.

Initially the unloaded beam is positioned to be horizontal by adjusting wings nut provided on the spring and initial reading on spring as noted. The beam then loaded as desired. This may be acheived by suspending masses m_1, m_2, m_3 at three places at a distance of n_1, n_2 & n_3 from the left ~~be~~ end. The loads actinge, at these locations are therefore m_1g, m_2g & m_3g. The two parts of beam tend to get disturbed from

S.No	Bending Moment Beam Diagram	Spring force (Kg) Initial	Final	Net	Exp. BM (Kgcm)	Th. B.M. (Kgcm)	% error
1.		0	0.5	0.5	15.75	21.75	27.59%
2.		0	0.4	0.4	12.60	22.75	44.6%
3.		0	0.6	0.6	18.9	20.12	6.08%
4.		0	0.7	0.7	22.05	23.5	6.17%
5.		0	0.8	0.8	28.35	32.25	12.1%

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Object: To verify the theoretical bending moment of aluminium beam apparatus at the section of the hinge using various combinations.

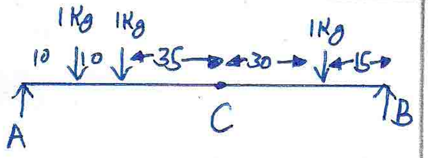
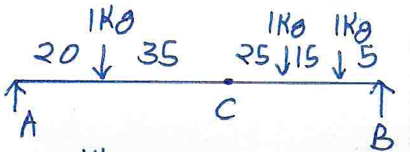
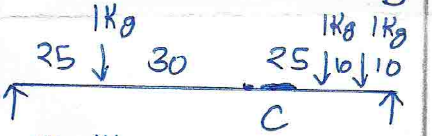
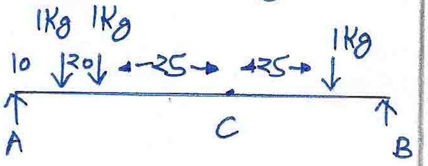
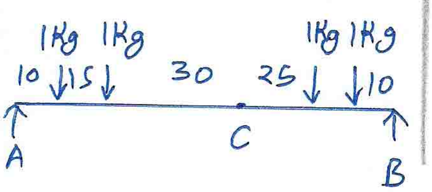
Apparatus Used: Wooden beam apparatus, lever.

Formula Used: Experimental bending moment = net spring force X Lever arm.

Observation - Constant Observation -

Lever arm = 31.5 cm

Observation Table.

S.No.	Beam Diagram	Spring Force Initial	Spring Force Final	Spring Force Net	Experimental Bending Moment	Theoritical Bending Moment	%age error
1.		0	0.5	0.5	15.75	21.75	27.59%
2.		0	0.4	0.4	12.60	22.75	44.61%
3.		0	0.6	0.6	18.9	20.12	6.06%
4.		0	0.7	0.7	22.05	23.5	6.17%
5.		0	0.8	0.8	[illegible]8.35	32.25	12.1%

the horizontal position on the application of the loads. The wing nut are turned suitably to bring them in the horizontal position.

Formula Used:-

Experimental bending moment
= net spring force X lever arm

The theoretical value may be obtained by computing the reaction R_A & R_B & then by noting that for equilibrium of assembly The magnitude of bending moment at the section equal the moment exerted by the force on the spring balance placed at an arm of a length a ie. $BM = S_2 a$

The theoretical may be obtained observation that for the equilibrium of left hand part,

$$-R_A x + m_1 g\,(x - x_1) + m_2 g\,(x - x_2) + BM = 0$$
$$BM = R_A x - m_1 g\,(x - x_1) - m_2 g\,(x - x_2)$$

Calculation:-

When spring force $= 0.5$
Experimental bending moment $= 0.5 \times 32.5$
$= 15.75$

Theoretical bending moment

$$BM = 21.75$$

Percentage Error $= \frac{21.75 - 15.75}{21.75} \times 100$

$= 27.59\%$

RESULT:- Within the limits of experimental error, the value of theoretical bending moment is found to be same.

DISCUSSION:- There is a slight difference b/w the theoretical bending moment and experimental bending moment because the system & surrounding are assumed to be ideal.

SOURCES OF ERROR:-

1:- Zero error of the spring balance must be removed completely.

2:- Weight must be put only at the gap provided in the beam.

3:- Length of lever arm and the distance of weight must be measured accurately with the of a scale.

Engineering Significance:

Bending moment diagram are used by engineers all the time to design bridge, building, boats, plants, etc. Bending moment concept is used by structural engineers or anyone dealing with force in materials.

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