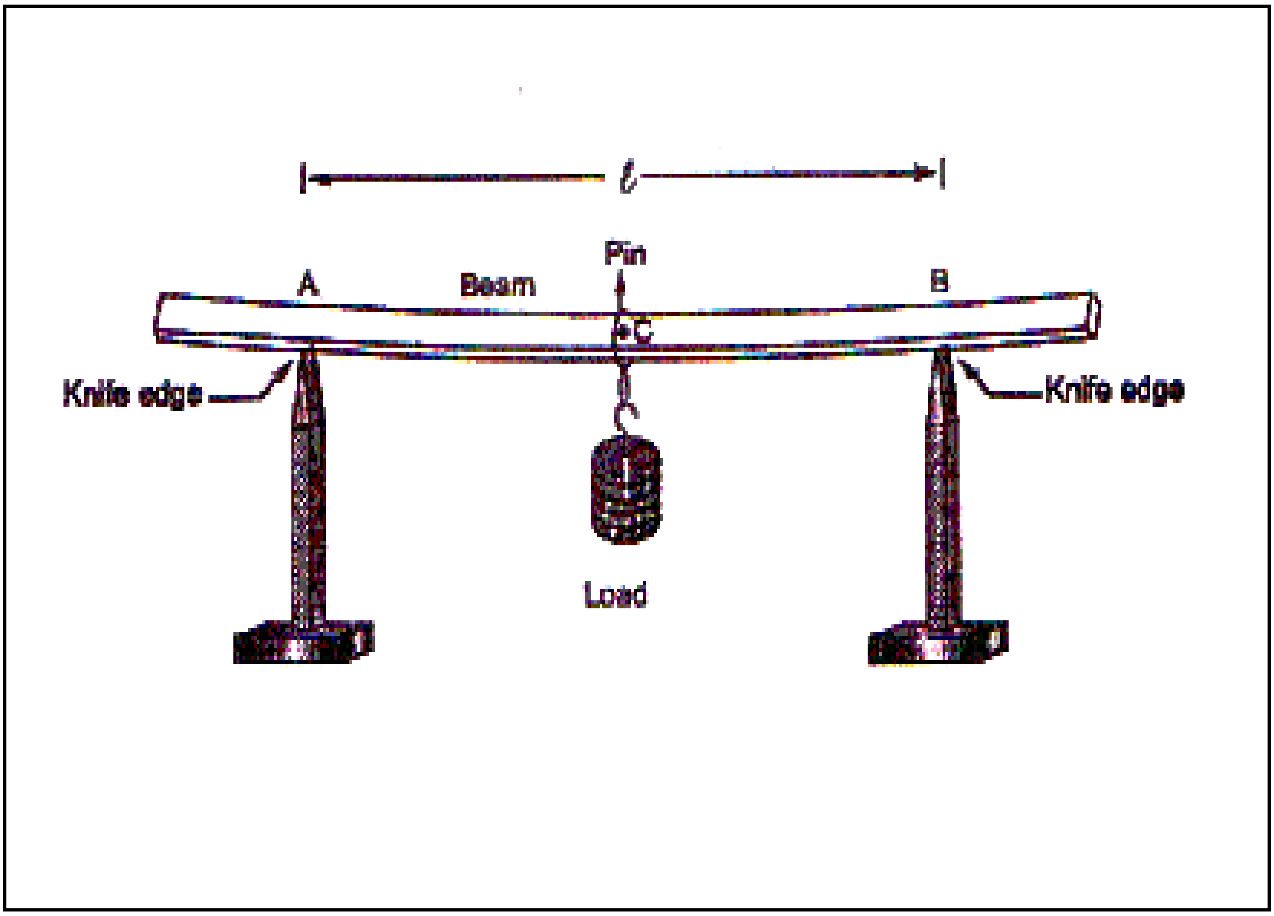

Fig 3.1. Young’s modulus – Non-uniform bending

EX.NO: 1	YOUNG'S MODULUS - NON UNIFORM BENDING
DATE:	

AIM:

To find the Young's modulus of the material of a uniform bar (metre scale) by non uniform bending.

APPARATUS REQUIRED:

Travelling microscope, two knife edge supports, weight Hanger with set of weights, pin, metre scale, vernier Calipers and screw gauge.

FORMULA:

Young's modulus of the material of the beam (metre scale)

$$Y = \frac{\mathrm{Mg}l^3}{4\mathrm{bd}^3 y} \ \mathrm{Nm^{-2}}$$

Where,

y=Mean depression for a load M in metre

g=Acceleration due to gravity in $\mathrm{ms^{-2}}$

l=Distance between the two knife edge in metre

b=Breadth of the beam in metre

d=Thickness of the beam (meter scale) in metre

M=Load applied in kg

PROCEDURE

The weight of the hanger is taken as the dead load W. The experimental bar is brought to elastic mood by loading and unloading it a number of times with slotted weights .with the dead load W suspended from the midpoint, the microscope is adjusted such that the horizontal cross – wire coincides with the image of the tip of the pin . The reading of the vertical scale is taken.

The experiment is repeated by adding weight in steps. Every time the microscope is adjusted and the vertical scale reading is taken. Then the load is decreased in the same steps and the readings are taken. From the readings, the mean depression of the mid-point for a given load can be found. The length of the bar between the knife edges is measured.

To find depression of the beam

LC=0.001cm

<table>
<tr><th rowspan="3">Load
X 10^{-3} kg</th><th colspan="6">Microscope Readings</th><th rowspan="3">Mean
cm</th><th rowspan="3">Depression y for
M kg
cm</th></tr>
<tr><th colspan="3">Loading</th><th colspan="3">Unloading</th></tr>
<tr><th>MSR
cm</th><th>VSC
div</th><th>TR
cm</th><th>MSR
cm</th><th>VSC
div</th><th>TR
cm</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Mean y =……….x10^{-2} m

The bar is removed and its mean breadth b is determined with is vernier caliper and its mean thickness d with a screw gauge. From the observations, young's modulus of the material of the beam is calculated by using the given formula.

CALCULATION

i. Distance between two knife edge l = ------------------------x10^{-2}m

ii. Depression for load applied y = -----------------------x10^{-2}m

iii. Load applied M = ------------------------kg

iv. Breadth of the beam b = -----------------------x10^{-2}m

v. Thickness of the beam d = ----------------------x10^{-3}m

To find the breadth of the Beam (b)

L.C= 0.01cm

S.No	MSR cm	VSC div	VSR = VSC x LC cm	Total reading (TR) =MSR+VSR cm
1.				
2.				
3.				
4.				
5.				
			Mean (*b*) = ………………………………… 10^{-2} m	

To find the thickness of the beam (d)

ZE = ±………..div

L.C = 0.01 mm

ZC = ±………..mm

S.No	PSR mm	HSC div	HSR = HSC x LC mm	Observed Reading =PSR + HSC mm	Correct Reading = OR ± ZC mm
1.					
2.					
3.					
4.					
5.					
				Mean (d)=………………………… 10^{-3} m	

RESULT

Young's modulus of the material of the given bar (meter scale) Y = …………………….Nm^{-2}

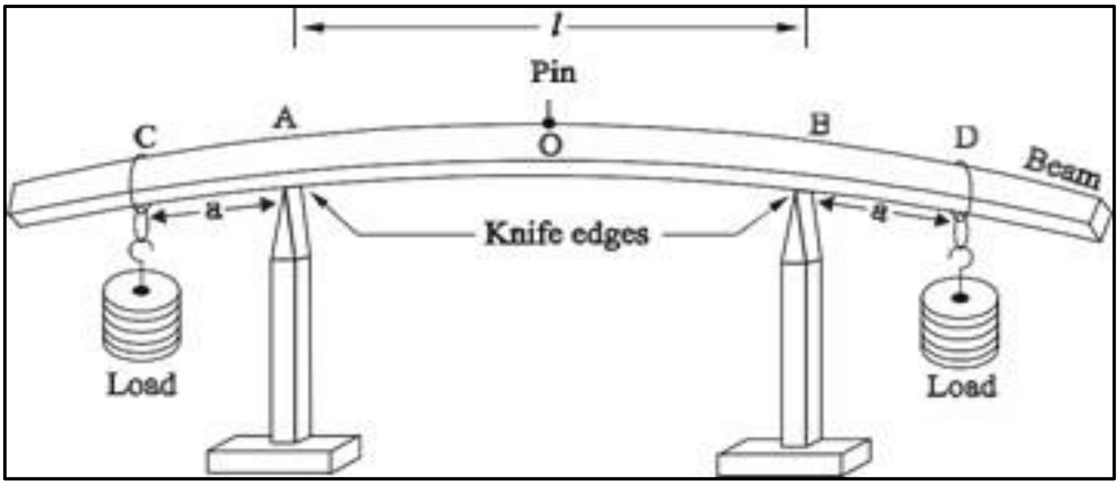

Fig 4.1. Young’s modulus uniform bending

To find the breadth of the Beam (b)

L.C= 0.01cm

S.No	MSR cm	VSC div	VSR = VSC x LC cm	Total reading (TR) =MSR+VSR cm
1.				
2.				
3.				
4.				
			Mean (b) = ………………………………… 10^{-2} m	

To find the thickness of the beam (d)

ZE = ±…………div

L.C = 0.01 mm

ZC = ±…………mm

S.No	PSR mm	HSC div	HSR = HSC x LC mm	Observed Reading =PSR + HSC mm	Correct Reading = OR ± ZC mm
1.					
2.					
3.					
4.					
				Mean (d)=………………………… 10^{-3} m	

EX.NO: 2	YOUNG'S MODULUS - UNIFORM BENDING
DATE:	

AIM

To determine Young's modulus of the beam (metre scale) by uniform bending method.

APPARATUS REQUIRED

Travelling Microscope, two knife edges, two set of slotted weights, pin, metre scale, vernier caliper, screw gauge

FORMULA

Young's modulus of the beam $(Y) = \frac{3Mga\,l^2}{2bd^3y}\ Nm^{-2}$

Where

y - Elevation of the beam for a load M (m)

M - Load applied (Kg)

g - Acceleration due to gravity (ms^{-2})

a - Distance between the point of application of load and the nearest knife edge (m)

l - Distance between the two knife edges (m)

b - Breadth of the beam (m)

d - Thickness of the beam (m)

PROCEDURE

The given beam is symmetrically supported on two knife edges and two weight hangers are suspended at equal distance from the two knife edges. A pin is fixed vertically at the midpoint of the beam. A suitabledead load *W* is suspended from each hanger.

Using Travelling microscope, the reading corresponding to the tip of the pin is taken. The load is equallyincreased on both weight hanger in steps of 50 gram up to 200 gram and the corresponding readings in the microscope are noted. Readings are also taken when the load in each hanger is decreased (unloading) in the same step. The readings are tabulated and the mean elevation is determined.

The distance between the two knife edges (*l*), the distance between the point of application of load and the nearest knife edge (*a*) are measured. The breadth (b) of the beam is determined using vernier caliper. The thickness (d) of the beam is measured using a screw gauge. From the observations, the Young's modulus of the material of the beam is calculated.

To find the elevation of the beam (y):

TR = MSR + (VSC×LC)

LC = 0.001 cm

Load X 10^{-3} kg	Loading			Unloading			Mean	Elevation y for M kg cm
	MSR cm	VSC div	TR cm	MSR cm	VSC div	TR cm	$\frac{TR_1+TR_2}{2}$ (cm)	
W								
W+50								
W+100								
W+150								
W+200								
							Mean (y)	**………………… cm**

Elevation of the beam (y) = …………………………. cm =………..x 10^{-2} m

OBSERVATION:

Mass of the load applied (M) = ……………….……….. gm =……………..…… x 10^{-3} kg.

Distance between two knife edges (l) = ……………….. cm =…………………….. x 10^{-2} m.

Distance between point of application of load and nearest knife edge distance

(a) = ………….......…. cm =……………..……. .x10^{-2} m.

Acceleration due to gravity (g) = 9.8 m s^{-2}

Breadth of the beam (vernier caliper) (b) = ……………….. cm =…………….. x 10^{-2} m.

Thickness of the beam (screw gauge) (d) = ……………….. mm =………..….. x 10^{-3} m.

Elevation y for load M kg is (y) = ……………………….….cm =………………..x 10^{-2} m.

CALCULATION

$$(\text{Y}) = \frac{3Mgal^2}{2bd^3y}\ Nm^{-2}$$

(or) Y = ………………………….

RESULT

The young's modulus of the materials of the beam is (Y) = ………………..…. Nm^{-2}