EXPERIMENT NO. 5

Objective:
To determine the central deflection of a simply supported beam loaded by a concentrated load at mid point and hence determine the modulus of elasticity of the material of the beam.

Apparatus:
Deflection of beam apparatus, Hanger and weights, Meter rod, Dial indicator, Vernier Calipers

Deflection of beam apparatus contains a metal beam and two knife-edge supports upon which the beam is supported for this experiment and hence the beam becomes of a simply – supported type.

Figure (a): Simply Supported Beam

Summary of Theory:
Beams are structural members supporting loads applied at various points along the members. A beam undergoes bending by the loads applied perpendicular to their axis of the structure. Beams are of various types.

If the supports are at the ends such that one of them is pin and other is roller then such a beam is called simply supported beam. The supports can be considered as simple wedges at the ends as shown in figure (a).

Consider a simply supported beam AB of length "L" and carrying a point load "W" at the centre of beam C as shown in figure (b).
The maximum deflection for simply supported beam will occur at half the distance from either support (mid-point).

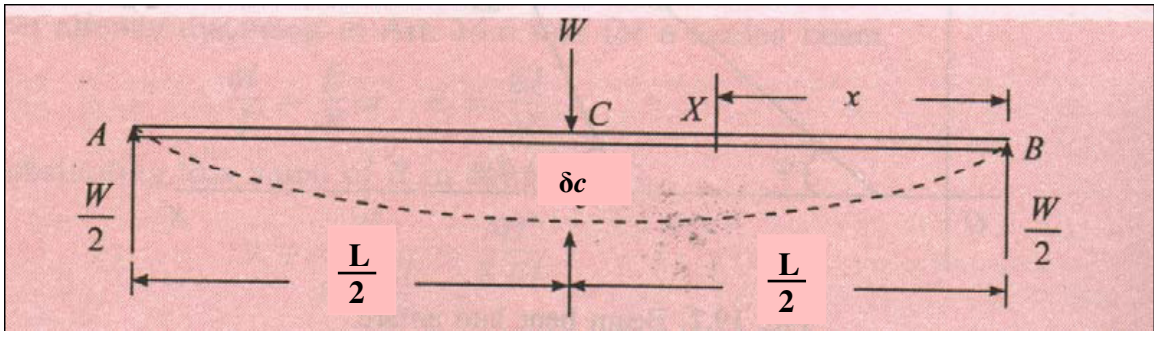

Figure (b): Simply Supported Beam loaded at mid span

Let,

δ = Deflection of beam at any point along the length of the beam
δc = Central deflection of beam
x = Variable distance from end B.

From the symmetry of the figure, we find that the reaction at A is:

$$R_A = R_B = W/2$$

The maximum deflection (y_c) at $x = L/2$ is given by:

$$\delta c = WL^3/ 48EI$$

or

$$\mathbf{E= (W/ \delta c) (L^3/ 48 I)}$$

Where E = Modulus of elasticity for the material of beam
I = Moment of inertia of the beam

Load-Deflection Curve:

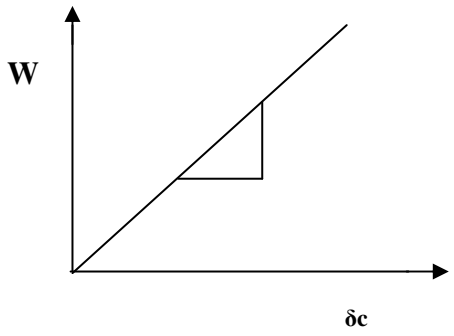

Figure (c)

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Procedure:

1. Set the Deflection of Beam apparatus on a horizontal surface.
2. Set the dial indicator at zero.
3. Apply a load of 1N and measure the deflection using dial indicator.
4. Take a set of at least five readings of increasing value of load and then take readings on unloading.
5. Calculate the "Modulus of Elasticity (**E**)" of the material of the beam.

Observations and Calculations:

Least Count of the dial indicator = _____ mm

Effective length of beam (L) =_____ m

Breadth of beam (b) =_____ m

Height of beam (h) =_____ m

Moment of inertia of the beam ($I=bh^3/12$) =_____ m^4

No. of Obs.	Effective Load-W (N)	Central Deflection-δc (mm)			W/ δc (N/mm) *From Graph*	Modulus of Elasticity $E=(W/\delta c)(L^3/48I)$ (MPa)
		Loading	Unloading	Average		
1.						
2.						
3.						
4.						
5.						
6.						
7.						

Name: _____ **Reg. # 2009-ME-_____**

Date:

Report:

The laboratory report should contain the following:

1. Plot of curve between Load **W** (Y-axis) and Extension δc (X-axis).Calculate the slope of the graph.
2. Hand calculations showing all results requested in (5) under procedure above.
3. A discussion of factors affecting the results of the experiment.
4. Practical Applications