Lab Manual **Mechanics of Materials-I**

EXPERIMENT NO. 7

Objective :

To determine the central deflection of a fixed ended beam loaded at mid-span by concentrated loads and to compare with theoretical value.

Apparatus:

Deflection of beam apparatus with clamps, hanger and weights, meter rod, dial indicator, vernier Caliper.

Deflection of beam apparatus contains a metal beam and two knife-edge supports upon which the beam is supported for this experiment. With the help of clamps arrangement at ends it can be made fixed type of beam.

Figure (a): Fixed Beam

Summary of Theory:
A fixed ended beam is supported by fixed supports at both ends as shown in Figure (a). The slope of the beam is thus zero at each end, and a couple will have to be applied at each end and to make the slope there have this value. The applied couples will be of opposite sign to that of bending moment, due to loading.

Consider a beam AB of length "L" fixed at A and B and carrying a point load "W" as shown in figure (b).
The maximum deflection for this fixed beam will occur at center of the beam (mid-point).
Let,

δ = Actual deflection of beam at any point along the length of beam
δc = Actual central deflection of beam
y_c = Theoretical central deflection of beam

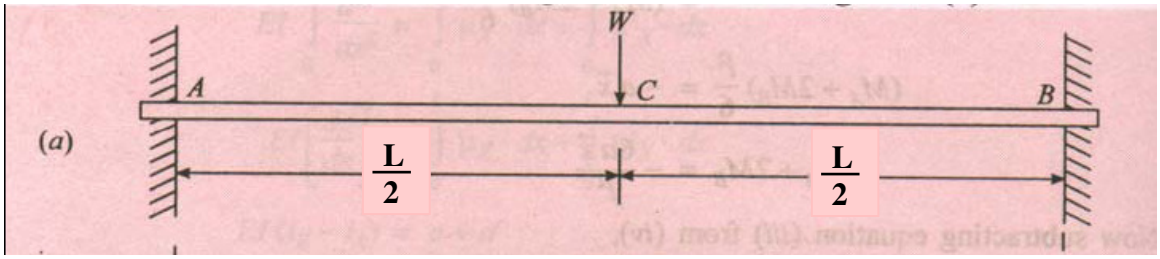

Figure (b): Fixed Beam loaded at mid span

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

$$\mathbf{y_c = WL^3 / 192EI}$$

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

Procedure:

1. Set the Deflection of Beam apparatus on a horizontal surface.
2. Set the dial indicator at zero.
3. Apply a load 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:

    a. The "Theoretical value of deflection ($\mathbf{y_c}$)" of beam at mid-span.
    b. The %age error between theoretical and experimental values of central deflections.

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

No. of Obs.	Load- W (N)	Actual Central Deflection-δc (mm)			Theoretical Deflection $y_c = WL^3/192EI$ (mm)	Percentage Error (%)
		Loading	Unloading	Average		
1.						
2.						
3.						
4.						
5.						
6.						
7.						

Name: _____ Reg. # 2010-ME-_____

Date:

Report:

The laboratory report should contain the following:

1. Hand calculations showing all results requested in (5) under procedure above.
2. A discussion / comments of the differences if occurred between theoretical and experimental values of central deflection.
3. Practical Applications.