Job # 6

To perform bending test on a wooden beam.

Apparatus:

- 10 ton Buckton UTM
- Wooden beam
- 3 deflection gages
- Measuring tape

Objective:

- To study the bending behavior of a wooden beam
- To determine the modulus of rupture and modulus of elasticity of beam.
- To determine the flexure stress.

Theory

- **Bending moment**:

The algebraic sum of moment of all the transverse forces acting on either the left or right side of any section is called bending moment at this location.

- **Shear force**:

A force which tends to slide one part of a section and acts perpendicular to axial axis is called shear force.

- **Elastic curve**:

The deflected shape of the beam after the application of load (in elastic range) IS CALLES elastic curve.

- **Bending stress/ flexural stress**:

The stresses caused by bending moment are known as bending or flexural stresses.

- **Bending formula/ flexural formula:**

The relation between flexure stresses and the bending moment is expressed by

$$\sigma = My/I$$

- **Modulus of rupture:**

It is the maximum tensile stress which can be developed in the beam before failure. Or it is also amount of energy of specimen absorbed up to failure.

$$\mathbf{MOR = 3Pa/bh^2}$$

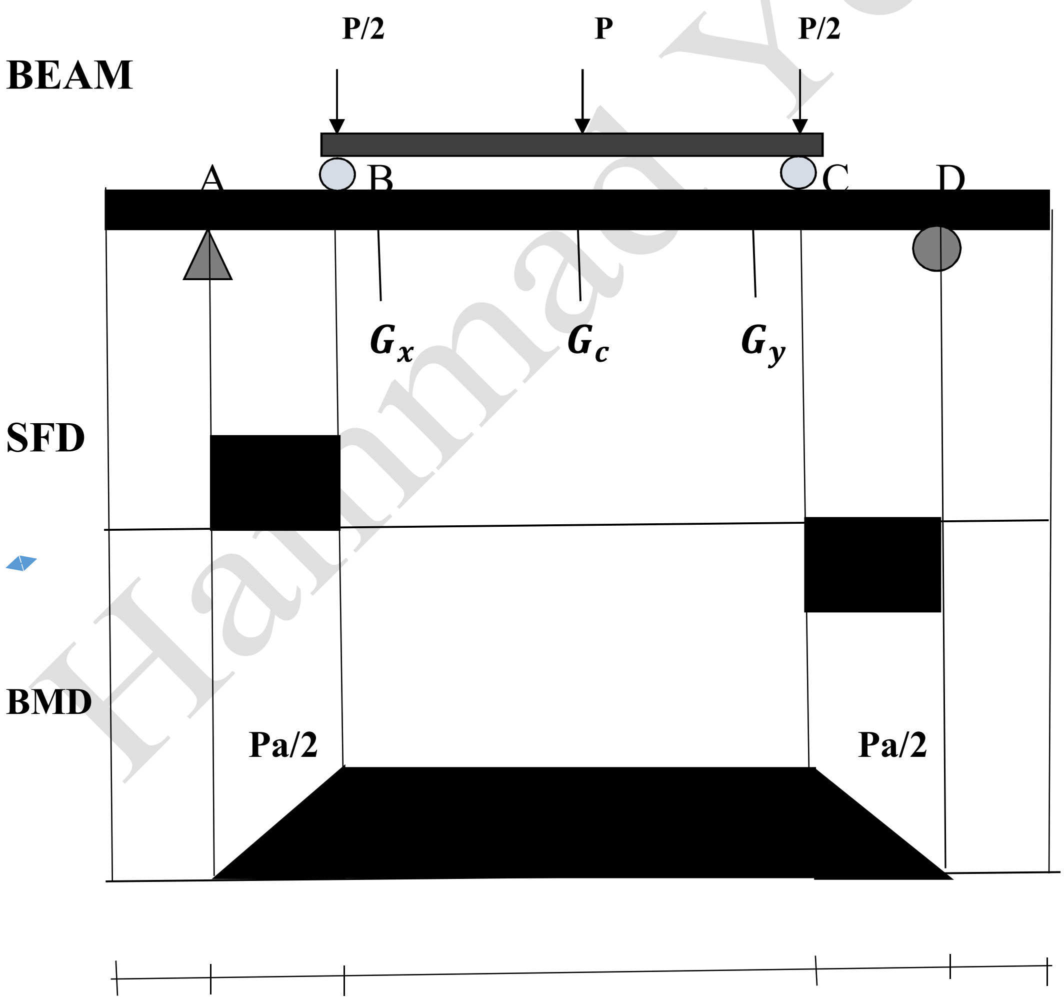
- **Modulus of elasticity:**

It is a ratio of stress and strain with in elastic limit. OR It is a energy absorbed by the specimen up to elastic limit.

$$\mathbf{MOE = 3al^2/4bh^3 * (\Delta p/\Delta s)}$$

NOTE : This formula is applicable for two point load setup as shown bellow.

Diagram:



50 150 500 150 50 (units : mm)

Procedure:

- First of all measure dimensions of wooden beam (length, width, height).
- Place wooden beam in 10 ton buckon UTM according to diagram.
- Connect three deflection gauges Gx, Gc, Gy At correct position according to diagram.
- Apply load carefully and all readings of load.
- Note readings of all gauges up to failure of beam.
- Calculate MOE and MOR values of beam.

Calculation and observation:

Total length of beam = L = 1000 mm

Distance between B and C =l = 500 mm

Distance between A and B = a = 150 mm

Width of beam =b = 50 mm

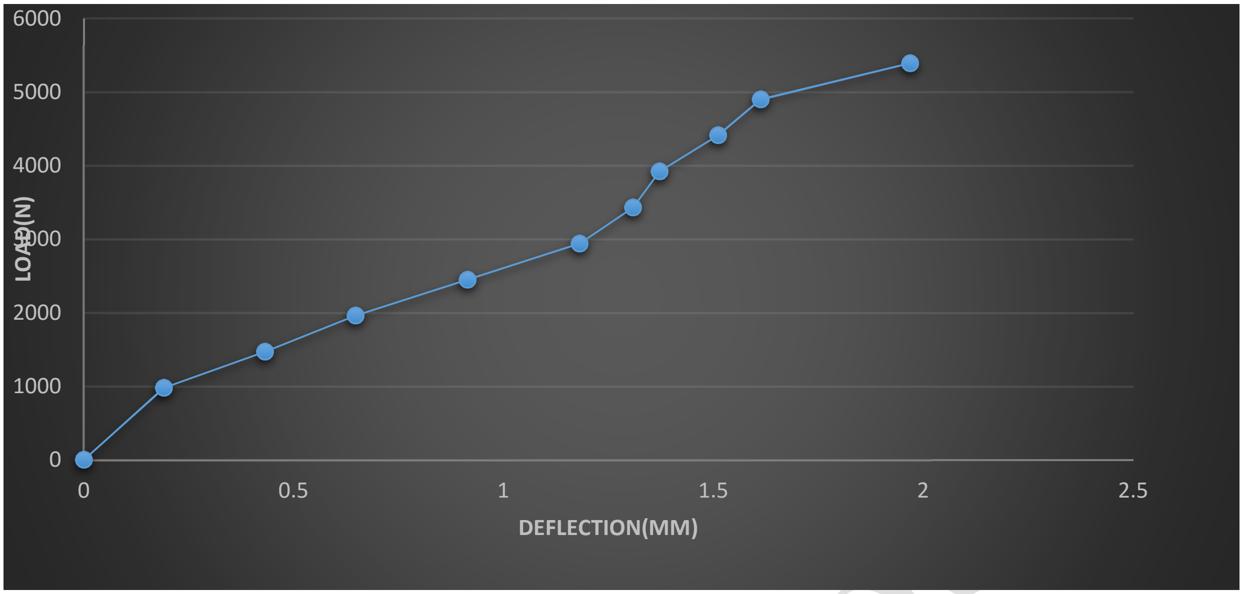
Height of beam = h = 50 mm

LOAD (TON)	LOAD (N)	G_x	G_y	Mean= $(G_x-G_y)/2$	G_c	Deflection (Gc - Mean) (mm)	
0	0	100	100	100	100	0	0
0.1	981	124	121	122.5	130	7.5	0.1905
0.15	1471.5	148	144	146	163	17	0.4318
0.2	1962	173	168	170.5	196	25.5	0.6477
0.25	2452.5	200	194	197	233	36	0.9144
0.3	2943	223	218	220.5	267	46.5	1.1811
0.35	3433.5	234	229	231.5	283	51.5	1.3081
0.4	3924	237	233	235	289	54	1.3716
0.45	4414.5	249	244	246.5	306	59.5	1.5113
0.5	4905	258	253	255.5	319	63.5	1.6129
0.55	5395.5	290	285	287.5	365	77.5	1.9685

Results:

MOE=9.86Pa

MOR = 77.69 MPa



Comments:

Modulus of rupture is 7.5 times greater than modulus of elasticity.

And within elastic limit Load is directly proportional to the deflection