STRUCTURE LABORATORY

Elements of Civil Engineering-I (CE-160)

LIST OF EXPERIMENTS

1. To verify the Theoretical Bending Moment by Wooden Beam Apparatus at the section of Hinge using various load combinations.
2. To determine Modulus of Elasticity *(E)* for the material of given beam(s) using Deflection Method.
3. To determine Izod and Charpy Impact Values of Mild Steel and Cast Iron specimen.
4. To determine Rockwell and Brinell Hardness of Mild Steel, Cast Iron and Brass specimen.
5. To plot Stress-Strain curves for Mild Steel and Cast Iron specimen using Universal Testing Machine (UTM) and to determine Modulus of Elasticity, Proof Stress and Ultimate Stress of the materials.

Name: Roll No.: Date:

EXPERIMENT NO. 1

OBJECT: To verify the Theoretical Bending Moment by Wooden Beam Apparatus at the section of Hinge using various load combinations.

APPARATUS USED:

FORMULA USED:

Experimental Bending Moment = Net Spring Force × Lever Arm

OBSERVATIONS:

Lever Arm = 34 cm

S. No.	Beam Diagram	Spring Force (kg)			Experimental Bending Moment (kg-cm)	Theoretical Bending Moment (kg-cm)	% Error
		Initial	Final	Net			
1.							
2.							
3.							
4.							
5.							
6.							

Signature

EXPERIMENT NO. 2

OBJECT: To determine Modulus of Elasticity *(E)* for the material of given beam(s) using Deflection Method.

APPARATUS USED:

FORMULA USED:

Deflection of Simply Supported Beam under the load subjected to Point Load at mid span

$$\Delta = \frac{WL^3}{48EI}$$

where, W = Point Load (kg)

L = Length of Span (cm)

E = Modulus of Elasticity (kg/cm^2)

I = Moment of Inertia of the beam section about the axis of rotation (cm^4)

$$= \frac{bd^3}{12}$$ (b = width and d = depth of the beam in cm)

OBSERVATIONS:

FOR MOMENT OF INERTIA

Least Count of the Vernier Calipers, LC = cm

S. No.	Reading on Main Scale (cm).	Reading on Vernier Scale		Total Reading (cm)	
		Divisions	Value (cm)	Individual	Average
WIDTH (b)					
1.					
2.					
3.					
DEPTH (d)					
1.					
2.					
3.					

FOR LOAD-DEFLECTION PLOT

S. No.	LOADING		UNLOADING		AVERAGE	
	Load (kg)	Deflection (cm)	Load (kg)	Deflection (cm)	Load (kg)	Deflection (cm)
1.	0.0	0.0	0.0		0.0	
2.						
3.						
4.						
5.						
6.						
7.						

Notes:
1. Plot Average Load (W) vs Average Deflection (Δ) on a graph paper.
2. Draw Best Fit Line passing through the origin.
3. Determine Slope of the Line.
4. Determine Modulus of Elasticity as $E = \frac{L^3}{48I} \times Slope$

EXPERIMENT NO. 3

OBJECT: To determine Izod and Charpy Impact Values of Mild Steel and Cast Iron specimen.

APPARATUS USED:

OBSERVATIONS:

IZOD IMPACT TEST

Parameters	Mild Steel	Cast Iron
Length (cm)		72.18 mm
Width (cm)		8.06 mm
Depth (cm)		8.06 mm
Depth of Notch (cm)		
Depth of Specimen at the Notch = Depth-Depth of Notch (cm)		
Distance of Notch from end (cm)		
Initial Reading on Impact M/C	0	0
Final Reading on Impact M/C	163.6	137.64
Impact Value = (Final – Initial) (kg-m)	163.6	137.64

CHARPY IMPACT TEST

Parameters	Mild Steel	Cast Iron
Length (cm)	55.16 mm	53.06 mm
Width (cm)	10 mm	8.02 mm
Depth (cm)	10 mm	8.02 mm
Depth of Notch (cm)		
Depth of Specimen at the Notch = Depth-Depth of Notch (cm)		
Initial Reading on Impact M/C	0	0
Final Reading on Impact M/C	297	133.9
Impact Value = (Final – Initial) (kg-m)	297	133.9

EXPERIMENT NO. 4

OBJECT: To determine Rockwell and Brinell Hardness of Mild Steel, Cast Iron and Brass specimen.

APPARATUS USED:

FORMULA USED: Brinell Hardness Number (BHN) = $$\frac{P}{\pi \frac{D}{2}(D-\sqrt{D^2-d^2})}$$

OBSERVATIONS:

ROCKWELL HARDNESS TEST

Applied Load (kg)	Size and Material of Indentor	Rockwell Hardness Value
MILD STEEL		
100	1/16" dia. Steel Ball	1. 2. 3. Average=
CAST IRON		
100	2.5mm dia. Steel Ball	1. 2. 3. Average=
BRASS		
100	1/16" dia. Steel Ball	1. 2. 3. Average=

BRINELL HARDNESS TEST

Applied Load (P) (kg)	Diameter of Indentor (D) (mm)	Diameter of Indentation (d) (mm)	BHN
MILD STEEL			
250	5.0		
CAST IRON			
187.5	2.5		
BRASS			
250	5.0		