Harshit Khare
Roll No.: 2005161
B-13 CSE

Date 17/05/2021

Page No. 01

Physics Lab Exam

Modulus of Rigidity -G- (Shear Modulus) is the coefficient of elasticity for a shearing force. It is defined as :-

"The ratio of shear stress to the displacement per unit sample length (shear strain)"

Modulus of Rigidity can be experimentally determined from the slope of a stress-strain curve created during tensile tests conducted on a sample of the material

Working formula :-

Time period of oscillation (T) of the torsional pendulum is given by

$$T = 2\pi\sqrt{\frac{I}{c}}$$

where I = Moment of inertia of the suspended body

c = Torsional couple per unit angular twist

The torsional couple per unit angular twist of the wire of radius (r) is given by

Teacher's Signature _____

$$C = \frac{\pi \eta r^4}{2l}$$

where l = length of suspended wire
η = Rigidity modulus of the material of suspended wire

Putting value of 'C' from eq^n (ii) in eqn (i) & then simplifying

$$\eta = \frac{8\pi I l}{r^4 T^2}$$

where
I = moment of inertia of solid disc $= \frac{1}{2} MR^2$
M: Mass of the disc
R: Radius of the disc

Tabulation:-

(Given mass of the metallic disc = 1160 gm
radius of the disc = 7.5 cm)

Table-I

For screw gauge, Pitch = 0.1 cm & L.C = 0.001 cm

No. of obs	MSR (I)	N	CSR (F)	I+F	PSR = P×N (cm)	CSR = (I+F) × L.C (cm)	Diameter = (PSR + CSR) (cm)	Mean Diameter (cm)
1	15	0	32	83	0	0.083	0.083	
2	10	0	25	85	0	0.085	0.085	0.014
3	8	0	24	84	0	0.084	0.084	

Table-2

Length in cm	No. of oscillations	Time in Sec	Time period (T) in sec	Mean T in Sec	T^2 in Se
$L_1=160$	10	106.9	10.690	10.711	114.739
	15	161	10.733		
$L_2=135$	10	97.72	9.772	9.7877	95.718
	15	147.05	9.803		
$L_3=110$	10	87.79	8.779	8.7845	77.167
	15	131.85	8.7900		
$L_4=85$	10	78	7.800	7.8200	61.152
	15	117.6	7.8400		
$L_5=60$	10	65	6.500	6.5200	42.510
	15	98.1	6.540		

Name:- Harshit Kharw

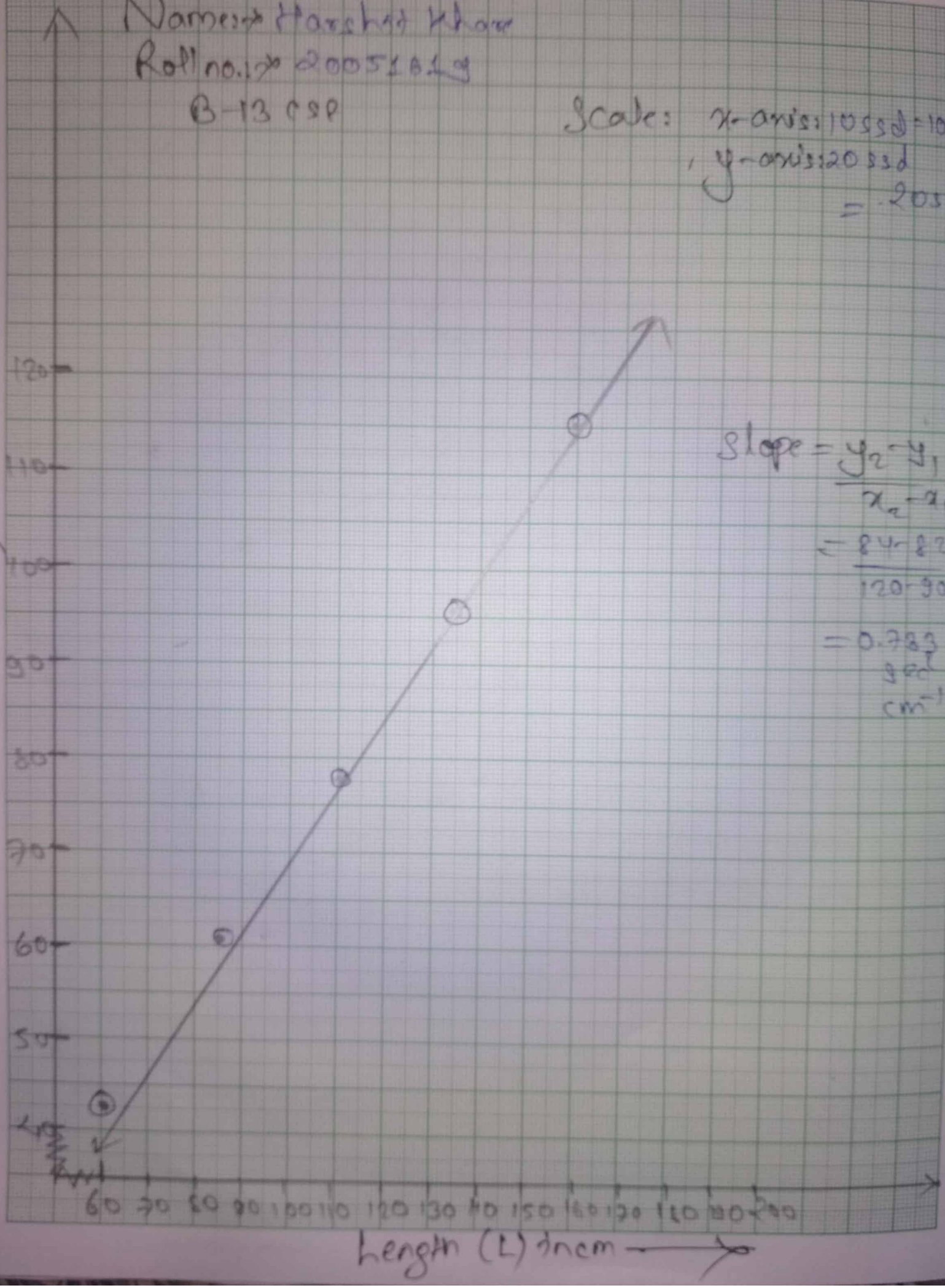
Roll no.:- 2005181

B-13 CSE

Scale: x-axis: 10 ss d = 10

, y-axis: 20 ss d

= 20s



$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{84 - 42}{120 - 90}$$

$$= 0.783 \text{ sec cm}^{-1}$$

Date

Expt. No. Page No.

Calculation:-

Modulus of rigidity

$$\eta = \frac{4\pi MR^2}{\alpha^4}\left(\frac{l}{r^2}\right)$$

$$= \frac{4\pi MR^2}{\alpha^4} \cdot \frac{1}{\text{slope}}$$

Now for slope

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{8 \cdot 4 - 2}{110 - 30} = 0.933 \text{ cm}^{-1}$$

$$\therefore \eta = \frac{4 \times 3.14 \times 1160 \times (6.5)^2}{(0.042)^4 \times 0.783}$$

$$= 3.61 \times 10^{11} \text{ dyne/cm}^2$$

Conclusion:-

The modulus of rigidity of the given wire from the above noted data was found to be 3.61×10^{11} dyne/cm^2

Teacher's Signature