Enrollment Id:- 20124051
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EXPERIMENT NO. 5

OBJECTIVE:To determine modulus of elasticity of a steel wire

THEORY: 1. All structural materials possess to a certain stress level the property of elasticity, i.e. if external forces, producing deformation of a structure, do not exceed a certain limit, the deformation disappears with the removal of the forces. When a member is loaded, the stress will be produced in the member. The magnitude of this stress is given by

$$\text{stress} = f = \frac{\text{Resultant Force (P)}}{\text{Original cross - sectional Area (A)}} \ldots \frac{N}{mm^2}$$

The deformation in the direction of resultant force in large as compared to that in other two direction the elongation per unit length of member is define as …

$$\textit{Strain} = e = \frac{dl}{L_o} \ldots \text{(Dimensionless)}$$ Strain e=dl/lo (dimensionless)

As stress is proportional to strain within the elastic limit (Hook's law)

$$\text{Modulus of elasticity} = E = \frac{f}{e} \ldots \frac{N}{mm^2}$$ (N/mm2)

2. As shown in graph, in elastic stage (1) the ductile material obeys hooke's law up to upper yield point. Between upper and lower yield point, material does not withstand additional force but there is a slight fall in force withstood and elongation continues. In stage (2) (i.e in elasto-plastic stage) the strain will not be proportional to stress and material does not remain in elastic stage. It does not attain original shape and size on removal of force. In stage (3), material will be fully in work hardening stage. Beyond ultimate tress, the cross-section starts reducing on application of force and fails at breaking stress which is less than ultimate stress. For design purpose, the working stress in considered with factor of safety (about 2 to 3) on yield stress.

PROCEDURE:

There are two wires of same material connected with the Searl's apparatus. There is a bubble tube between them. Initially suspend the counter, weight on one wire and only hook on the other and take initial reading of micrometer by bringing bubble in the center. Now, suspend the load on the hook so that the test wire will be elongated. As a result, bubble will be shifted. With the micrometer screw, bring the bubble in the center. This will be final reading on the micrometer. The difference of final and initial reading will give the elongation of test wire due to load kept on the hook. Suspend different loads, and take corresponding final readings. This will complete one cycle. In the same manner, complete three cycles. Thus, for a particular load, there will be six readings. Average of them will be elongation for corresponding load. Draw a graph between stress and strain.

Observation Table:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2		SR NO.	No. LOADING P(excluding hook)gm	No. LOADING P(excluding hook)N	MICROMETER READING dl						dl=Average of(1) to (6)	Stress f= P/A0	Strain=dl/L0	Modulus of elasticity E=f/e (N/mm^2)	
3					FIRST CYCLE		SECOND CYCLE		THIRD CYCLE						
4					Loading mm(1)	Unloading mm(2)	Loading mm(3)	Unloading mm(4)	Loading mm(5)	Unloading mm(6)					
5		1	500	5	1.8	1.8	1.76	1.79	1.73	1.82	1.783333333	23.1481481	0.0011889	1.95E+04	
6		2	1000	10	2.16	2.3	2.18	2.13	2.15	2.22	2.19	46.2962963	0.00146	3.17E+04	
7		3	1500	15	2.36	2.43	2.35	2.37	2.38	2.4	2.381666667	69.4444444	0.0015878	4.37E+04	
8		4	2000	20	2.51	2.58	2.53	2.53	2.56	2.59	2.55	92.5925926	0.0017	5.45E+04	
9		5	3000	30	2.86	2.6	2.87	2.84	2.84	2.82	2.805	138.888889	0.00187	7.43E+04	
10	40	6	Unknown P	40	3.91	3.91	3.95	3.95	3.92	3.93	3.928333333	185.185185	0.0015613	4.47E+04	Avg of all 5 observation
11			Reverse Calculation										Avg.of all 5 observations		

Graph:

40	3.91	3.91	3.95	3.95	3.92	3.93	3.928333333	185.185185	0.0015613
									Avg.of all 5 observations