NILE UNIVERSITY OF NIGERIA

Faculty of Natural and Applied Sciences

Department of Computer Science

Physics Unit

PHY 107: Experimental Physics I (Mechanics)

Experiment 2: Hook's law

Student Name:

Student ID:

Department:

Date of the Experiment:

Group:

Purpose:

To determine the validity of Hooke’s law using helical springs of unknown spring constants.

Apparatus:

1. A tripod base
2. A barrel base
3. A support rod, square
4. A right angle clamp
5. Cursors, 1 pair
6. A weight holder f. slotted weights
7. 4 slotted weight, 10 g, black
8. 5 slotted weight, 50 g, black
9. A helical spring, 20 N/m
10. A meter scale (±0.1 cm)
11. A holding pin

Theoretical background:

An important property of solids is their ‘’stretchiness’’ or ‘’squeeziness,’’ which is called their elasticity. In the case of many solids, the amount of stretch or squeeze is proportional to the force causing the stretch or squeeze. This relationship can be expressed as:

$$F \propto x$$

Which is read as ‘’force is proportional to stretch (or squeeze)’’. To change this expression into an equation, a constant of proportionality must be included. The expression ends up taking the form:

$$F_s = -kx$$

Where k is the constant of proportionality (in this case, the spring constant). The value for k depends on the material being stretched or squeezed. This equation expresses what has come to be known as Hooke's Law.*** Your problem in this experiment is to see if the spring on the apparatus obeys Hooke's Law, and find the value of k for your spring.*** The spring potential energy, PE_{spring} or U_s, can be written as

$$U_s = \frac{1}{2}kx^2$$

Set-up and Procedure:

Fig. 2

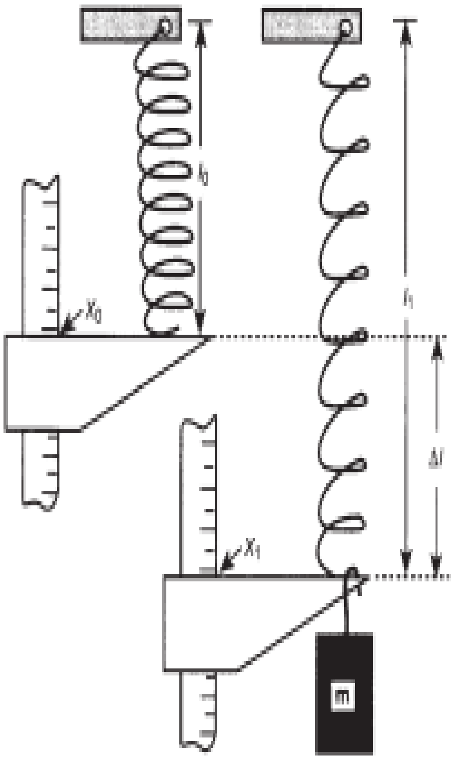

Fig. 1

1. The experimental set-up to measure the spring constants is shown in Figure 1
2. To start with, submit the helical spring to no stress.
3. The equilibrium position of the spring, L_0 (set the sliding pointer to the lower end of the spring) is determined. The length of the spring, l_0 is recorded.
4. A mass on the helical spring is inserted using the weight holder and the slotted weight. The Stretching of the spring, Δl is recorded (refer Figure 2)
5. The mass is increased on the helical spring in steps of 40 g, until it reaches the maximum mass of 200 g. (i.e. 10, 50, 90, 130, 170, 210, 250g respectively)
6. For every 40g of mass inserted, the Load F, the Initial Length L_0, the Final Length L and the extension ΔL is recorded as given in the table below.
7. Plot F against ΔL.

8. From your graph, determine the value of the force constant of the helical spring?

Data Sheet:

Data number	Mass of Load (g)	Load, F(N)	Initial length L_0(m)	Final length L(m)	Extension $L - L_0 = \Delta L$ (m)
1					
2					
3					
4					
5					
6					
7					

Instructor Signature and Date____

Title: **Scale:**

PRECAUTIONS:
State the precautions taken to ensure accurate result.

Discursion of Result and Conclussion

Questions:

1. Using your graph above, what is ΔL when a mass of 200g is inserted on the weight holder? (NB, this must be indicated on your graph)
2. Define Young Modulus and Force constant
3. A wire of cross sectional area of $6 \times 10^{-5} m^2$ and length 50cm stretches by 0.4mm under a load of 3000N. What is the Young's Modulus of the wire?
4. A spiral spring is compressed by 0.03m. Calculate the energy stored in the spring if its force constant is $300 Nm^{-1}$.