Department of biology

# Department of biology

## 2025-2026

## ((Biophysics))

## Stage (1)

**LEC ((Lec 1))**

# Hooke's law

**By**

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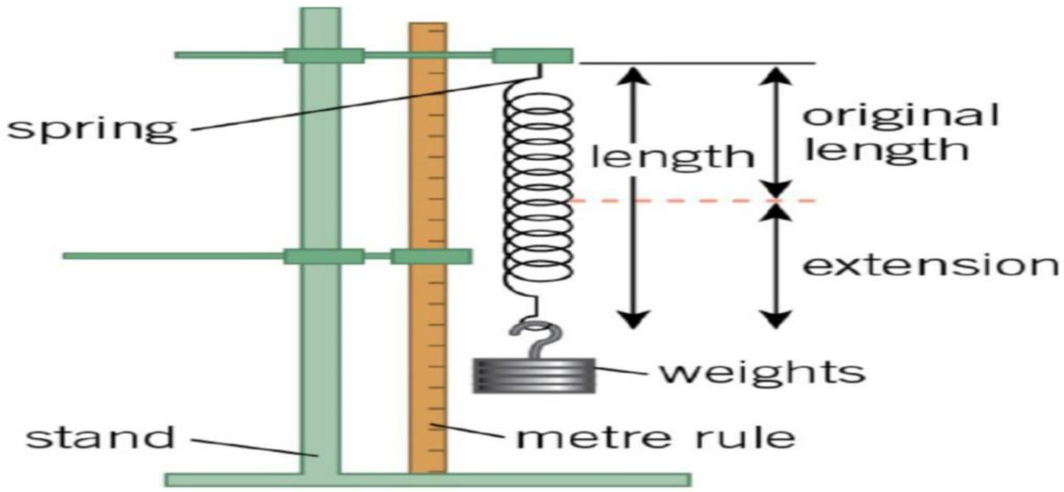
## The purpose of the experiment:

Investigate Hooke's law and find the value of the helical spring constant.

## Used equipment's

1. Helical spring fixed vertically on a stand.
2. Stand with a graduated scale beside the spring.
3. Pointer (indicator) for measuring extension.
4. Standard weights.
5. Portable stand.
6. . Stopwatch .
7. . Stand with holder (clamp)
8. Metric ruler or measuring tape.




## Theory :-

Robert Hooke discovered that there is a relationship between the force applied to an elastic body and the deformation produced. Stress is defined as the force acting per unit area, while strain is defined as the ratio of the change in length to the original length of the body.

Hooke's law states that the extension or compression of a spring is directly proportional to the applied force, provided that the force does not exceed the elastic limit of the spring.

Mathematically, this relationship is expressed as:

$$Y = \frac{F/A}{\Delta L/L_0} \quad ....(1)$$

Where:

F: Applied force

A: Cross-sectional area of the spring

ΔL: Change in length

$L_0$: Original length of the spring

The spring constant (K) represents the force required to produce a unit extension in the spring and is given by:

$$K = \frac{F}{\Delta L} = \frac{M.g}{\Delta L} \quad ...(2)$$

The value of the spring constant depends on the material and dimensions of the spring and remains constant as long as the spring operates within its elastic limit.

## Work steps-:

1. Fix the spring vertically on the stand as shown in the experimental setup.
2. Attach the pointer to the lower end of the spring so that it points toward the graduated scale.
3. Record the initial length of the spring when no mass is attached (original length).
4. Hang a mass of 20 g on the spring.
5. Record the new length of the spring after extension.
6. Calculate the applied force using the equation: $F = M \times g$.
7. Calculate the extension by subtracting the original length from the final length.
8. Repeat the procedure by adding equal masses and record all readings.

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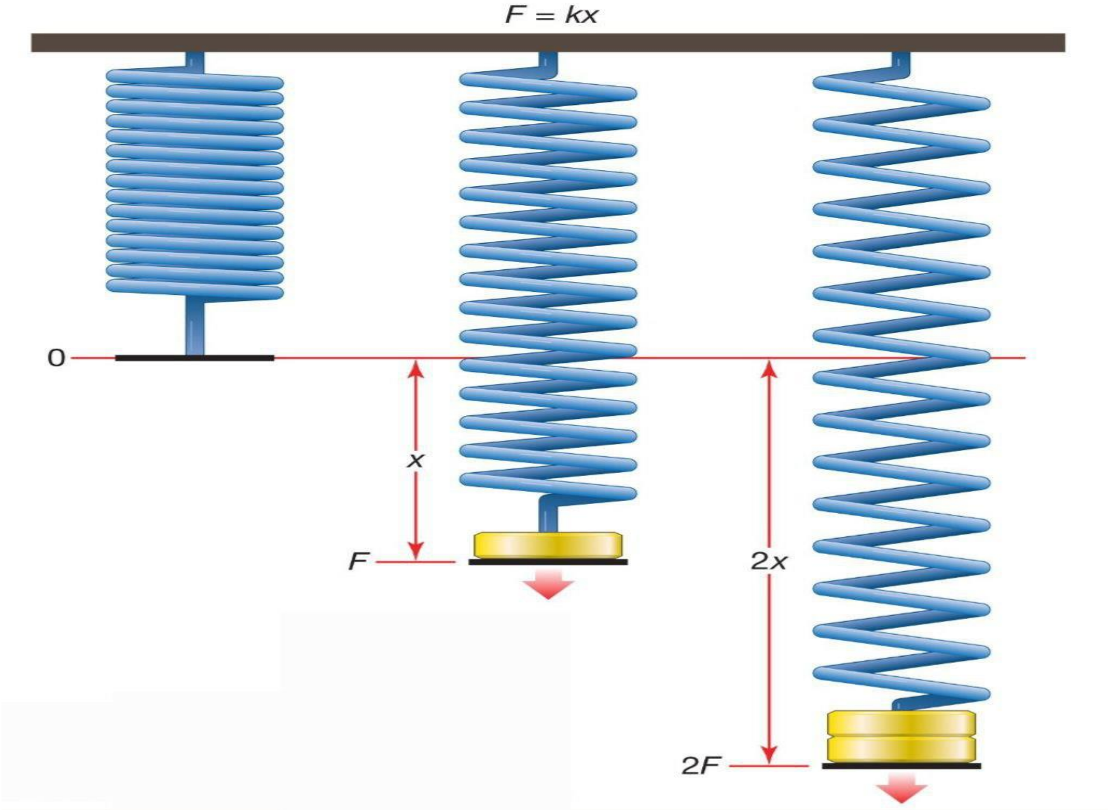
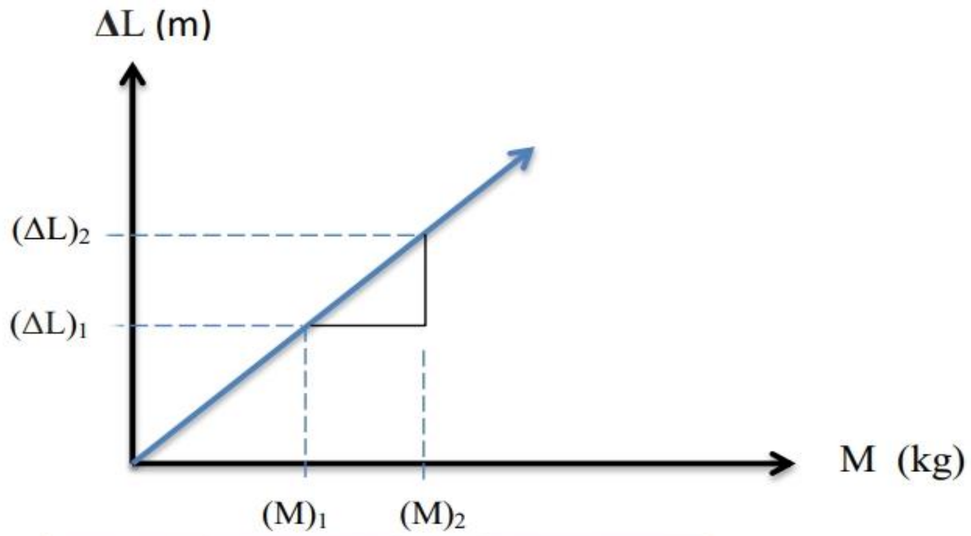



| Trial | Masses M (kg) | The force resulting from the suspended weight F=M*g | The original length of the spring $L_{\circ}$ (m) | |
|---|---|---|---|---|
| | | | The new length of the spring L (m) | The amount of elongation $\Delta L = L - L_{\circ}$ (m) |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 4 | | | | |
| 5 | | | | |




$$\text{Slope} = \frac{\Delta(\Delta L)}{\Delta(M)} \quad , = \frac{\Delta L_2 - \Delta L_1}{M_2 - M_1}$$

$$\boldsymbol{K = \frac{F}{\Delta L} = \frac{M.g}{\Delta L}}$$

$$\boldsymbol{K = \frac{g}{Slope}}$$