Assignment-1
EE:1205 Signals and Systems
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I. QUESTION 11.14.8

A spring balance has a scale that that reads fro 0 to 50 kg. The length of the scale is 20cm. A body is suspended from this balance , when displaced and released, oscillates with a period of 0.6s. What is weight of the body?

II. SOLUTION

The maximum mass that the scale can read is given by:

$$M = 50\,\text{kg} \qquad (1)$$

The maximum displacement of the spring is equal to the length of the scale, given by:

$$l = 20\,\text{cm} = 0.2\,\text{m} \qquad (2)$$

The time period is given as:

$$T = 0.6\,\text{s} \qquad (3)$$

The maximum force exerted on the spring is calculated using:

$$F = Mg \qquad (4)$$

where g is the acceleration due to gravity ($9.8\,\text{m/s}^2$):

$$F = 50 \times 9.8 = 490\,\text{N} \qquad (5)$$

The spring constant, k, is calculated as:

$$k = \frac{F}{l} = \frac{490}{0.2} = 2450\,\text{N/m}^{-1} \qquad (6)$$

The time period, t, for mass m suspended from the balance is given by:

$$t = 2\pi \sqrt{\frac{m}{k}} \qquad (7)$$

Hence, solving for m:

$$m = \left(\frac{T}{2\pi}\right)^2 \times k = \left(\frac{0.6}{2 \times 3.14}\right)^2 \times 2450 = 22.36\,\text{kg} \qquad (8)$$

The weight of the body is calculated as:

$$\text{Weight} = mg = 22.36 \times 9.8 = 219.16\,\text{N} \qquad (9)$$

Therefore, the weight of the body is approximately $219\,\text{N}$.