**Sonometer**

**Experiment No.: \_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Aim:**

To verify the laws of transverse vibrations of stretched strings using Sonometer

**Apparatus:**

1. Sonometer
2. Slotted weights
3. Two wedges
4. Sensitive balance
5. Weight box
6. Rubber hammer

**Working formula:**

The frequency f the fundamental note for the transverse vibration of a stretched string is given by

|  |
| --- |
|  |

Where *l* = length of the vibrating segment of the Sonometer wire

T = Mg = Tension applied to the wire

= mass per unit length of the wire

**Procedure:**

1. To set the Sonometer, place two sharp wedges under the wire of the Sonometer. Load the hanger with a load of about 4 kilogram including the hanger. See that the wire is properly stretched between the wedges and touches both of them. Wooden blocks may be placed under the wedges, if necessary. See that there are no kinks in the wire.
2. Bring two wedges close to each other. Cut a piece of paper about 2 cm long and about 2 mm wide. Fold it into V shape. Place this paper rider on the wire between the wedges.
3. Taking the tuning fork of the frequency provided, strike gently at the end of its prongs with a rubber hammer to set into vibrations. Place the stem against the Sonometer board keeping the tuning fork vertical. At the same time, move one of the wedges outwards very slowly till the rider, which is always kept at the midway between two wedges, begin to flutter. Strike the tuning fork again and again during this adjustment and press against the board to keep it vibrating. If the adjustment is now made very carefully, the paper rider flies off at certain fixed distance between wedges. The wire now vibrates in resonance with the frequency of the tuning fork.
4. Measure the length of the wire between the wedges by a meter rod. Increase the distance decreasing the distance between the wedges.
5. Take four such observations by changing the load.
6. **To verify the law of length**

i.e. = constant (Keeping ‘T’ and ‘m’ as constant)

**Observations:**

**Table – 1:** (Load including the hanger = \_\_\_\_\_\_\_\_\_\_ Kg)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No of Obs. | Frequency in (n) Hz | Distance between wedges | | |  |
| Length increasing in cm | Length decreasing in cm | Mean Length (*l*) in cm |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |

**Remark:-**

1. **To verify the law of tension**

i.e. Or = constant

1. Take a load of 3 kg including the hanger. Obtain the length of the wire which vibrates in resonance with one of the tuning forks.
2. Increase the load by 0.5 kg and repeat the experiment with same tuning fork.
3. Similarly repeat with 3 different loads.

It is not possible to find directly the frequency with which the same length of wire will vibrate under different loads. If *l*1 and *l*2 are the lengths of the wire vibrating with the same frequency n1 under the loads T1 and T2 respectively, then the frequency of sound n2 produced by the same length *l*1 under the load T2 can be calculated as follows;

Under a load T2 the length *l*2 of the wire produces a frequency n1

Applying the law of length,

Under the load T2 the length *l*1 will produce a frequency

**Observations:**

**Table – 2:** (Frequency of the tuning fork n1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_Hz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No of Obs. | Tension in Newton () | Length of the wire giving the frequency n1 | | | Calculated frequency for a length *l*1 |  |
| Increasing | Decreasing | Mean *l*  (in metres) |
| 1 | T1 |  |  |  | = |  |
| 2 | T2 |  |  |  |  |  |
| 3 | T3 |  |  |  |  |  |
| 4 | T4 |  |  |  |  |  |

**Remark:-**

1. **To verify the law of mass per unit length** i.e. or is constant.
2. Stretch the wire with a load of 4 kg including the hanger and find the length of the wire which vibrates in resonance with a tuning fork as explained.
3. Repeat with the same load and the same tuning fork for three different wires.
4. Find the area of cross section of the wire using screw gauge.

**Table – 3:** (Diameter of the wire)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No of Obs. | ICSR | FCSR | NCR | Diff. (I - F) | P.S.R. in cm | C.S.R. in cm | Total in cm | Mean in cm |
| 1 |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |

**Standard values:**

Density of the given wire (Copper) = 8.93 gm.cm-3

Density of the given wire (Steel) = 7.9 gm.cm-3

Area of cross section of the wire = cm2

Mass per unit length () of the wire =

**Table – 4:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No of Obs. | Length of the wire giving the frequency n1 | | | Calculated frequency for the length *l*1 | Mass per metre of the wire ‘m’ (in kg/m) |  |
| Increasing | Decreasing | Mean *l* (in metres) | m |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |

**Remark:-**

**Conclusion:**

**Marks Awarded**

Signature of the student:

|  |  |  |  |
| --- | --- | --- | --- |
| Planning and Execution  (2) | Result and Report  (6) | Viva  (2) | Total  (10) |
|  |  |  |  |

Regd. No:

Group:

Branch:

Signature of the faculty