**COMSATS University, Islamabad**

**Experiment # 1**

**Measurement of Frequency of AC Supply by Melde’s Apparatus**

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**Equipment:**

1. Melde’s apparatus (vibrograph)
2. AC Supply
3. Pulley with stand
4. Two small optical pins with stands
5. Light string of about 2 meters
6. Pan
7. Weight box
8. Meter scale

**Introduction:**

The frequency of AC is given by

Where **f** is the frequency of AC supply (or frequency of transverse standing waves produced in strings), **l** is the distance between two successive nodes, i.e., equal to the length of a loop, **M** is total mass suspended to the string, i.e., mass placed in pan + mass of pan, **g** is acceleration due to gravity, and **m** is mass per unit length of string.

**Lab Procedure:**

If the mass per unit length of string is not known, measure full length of string say 2m, and weight it to the nearest milligram. Divide the measured mass by its length to get mass per unit length m of string. Also note the mass of pan m1

One end of string is tied to the iron strip of vibrograph, and the other end is passed over a frictionless pulley and is attached to a light pan. Take care that the pan does not touch the table or any other thing.

Stretch the string by placing some mass m2 say 2g, in the pan attached at the end of the string and set vibrograph to vibrations by switching the current on. The length of the string is adjusted by moving vibrograph or position of vibrating strip is adjusted until standing waves having amplitude of about 1-2 cm are seen in the string.

Now one optical pin each is placed at the second and the second last node formed in string and the distance L between these two optical pins is measured by meter scale, and the number of loops n formed between the optical pins are counted.

The ends of the string are not true nodes, and measurements should not be made from these points. Record the value of L and n and hence find out the l of one loop. After the values of tension in the string by changing weight in pan, say 5, 10, 15 and 20 g, and repeat the operation five times for each weight to find L and n.

Determine the frequency of AC supply in each case by using formula and take the mean value.

**Diagram:**

**Observations:**

Mass per unit length of string = m = 0.003g

Mass of Pan = m1 = 13.4g

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mass in pan**  **m2**  **(gm)** | **Total Mass**  **M=m1 + m2**  **(gm)** | **No of loops**  **n** | **Total length of n loops L**  **(cm)** | **Length of one Loop l=L/n**  **(cm)** | **AC Frequency**  **(Hz)** | **Mean frequency of AC**  **(Hz)** |
| 5 | 18.4 | 4 | 128 | 32 | 38.31 | 45.42 |
| 10 | 23.4 | 4 | 32 | 43.19 |
| 20 | 33.4 | 3 | 42.67 | 38.71 |
| 50 | 63.4 | 2 | 64 | 35.55 |
| 100 | 113.4 | 3 | 42.67 | 71.32 |

The frequency of AC supply is given as

**= 45.42Hz**

**Result:**

The frequency of AC supply = 45.42 Hz

**Sources of errors:**

1. Vibrating strip or length of string should be so adjusted hat the loops formed are sharp, stationary and of maximum amplitude.
2. The pulley used should be frictionless and in the line with the string.
3. The string should be of uniform diameter.
4. The pan should be light.
5. The string and pan should be kept off the table.
6. Optical pins should be carefully adjusted.