Experiment no: 09

Name of the Experiment: Determination of the line frequency of Alternating voltage system generated by the electric power plant with the help of an alternating voltage signal of known frequency by forming Lyssagous curves in an oscilloscope and the determination of the time base of an oscillascope

Questions on theory (all diagrams should be drawn by using a pencil and a scale)

*1) What is 'power line frequency'? [0.25]

Ans: It is the normal frequency of the oscillation of alternating current in an electric power grid transmitted from a power station to ~~the~~ the end user.

2) Briefly explain how a cathode ray oscilloscope works. [1]

Ans: There is a circular metallic disc, a short distance away from the coil. The disk is connected with a terminal. Two different voltage, negative and positive is created. The metal disc is anode and coil is cathode. The flow of electron between these two is called cathode ray. The system to ~~power~~ produce cathode ray is called ray gun. For increasing and decreasing of charge the voltage will also be in upward and downward. Finally the cathode ray strikes a screen of ~~the~~ the display box of the oscilloscope. The screen is ~~converted~~ covered with flourescent zinc ~~to~~ sulphite layer. The point glows where the ray strikes. The amount of maximum deflection of the cathode ray depends on the speed of the electrons and the amplitude of the altering electric fields magnitude between the plates.

*3) What is Lissajous curve? [0.25]

Ans: It is the graph of a system of parametric equation : $x = A\sin(at+\gamma)$, $y = B\sin(bt)$ when t is the parameter ; a, b, A, B, δ are constants.

4) See the Figure 11

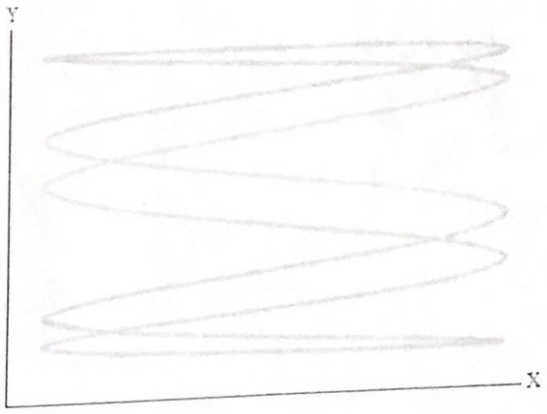

Figure 11: Figure for question 4

For this Lissajous curve what is T_x / T_y ? [1]

Ans: $\frac{T_x}{T_y} = \frac{1}{5}$

*5) Write down the working formula to find out the unknown frequency of a voltage signal, by using another voltage signal of known frequency and forming Lissajous curve. Mention what every variable represents. [0.5]

Ans: $\frac{f_x}{f_y} = \frac{n_x}{n_y}$

n_x = no. of full cycles completed along x axis for a complete cycle around the Lissajous curve

n_y = no. of full cycles completed along y axis for a complete cycle around the Lissajous curve.

f_x and f_y are the frequencies of the voltage signals given in Channel 1 (x) and Channel 2 (y) respectively.

*6) What is *time base* of an oscilloscope? [0.5]

Ans: Time base of an oscilloscope is the amount of ~~the~~ time represented by a single division of ~~the~~ horizontal side of a square drawn on the display box of the oscilloscope

*7) Write down the working formula to find out the time base of an oscilloscope by observing the voltage vs. time curve and knowing the frequency of the alternating voltage. Mention what every variable represents. [0.5]

Ans: $T_B = \frac{1}{Df}$

D = no. of divisions between two consequetive peaks

f = frequency

T_B = Time Base of an oscilloscope.

8) See Figure 9. If the frequency of the input alternating voltage is 50 Hz then what is the time base of the oscilloscope? [1]

Ans:

$D = 4.$

$$T_B = \frac{1}{Df}$$

$$= \frac{1}{4 \times 50}$$

$$= \frac{1}{200}$$

Time base of the oscilloscope as shown by the **TIME/DIV Knob (15)** (Figure 15)

Percentage of deviation of the experimental value of the *time base* from the value shown by the "TIME/DIV" Knob's pointer:

- **READ the PROCEDURE carefully and perform the experiment by YOURSELVES. If you need help to understand any specific point draw attention of the instructors.**
- **DO NOT PLAGIARIZE data from other group and/or DO NOT hand in your data to other group. It will bring ZERO mark in this experiment. Repetition of such activities will bring zero mark for the whole lab.**
- **Perform calculations by following the PROCEDURE . Show every step in the Calculations section.**
- **Write down the final result(s)**

Calculations $f_y = \frac{\Delta_y}{\Delta_x} = \frac{150}{3} = 50$ | $T_B = \frac{1}{\frac{\Delta_y}{\Delta_n}} = \frac{1}{\frac{.15}{0.3}} = \frac{1}{150}$

Results: $f_y = 50$, $T_B = \frac{1}{150}$

- **TAKE printout of the 'Questions for Discussions' BEFORE you go to the lab class. Keep this printout with you during the experiment. ANSWER the questions in the specified space AFTER you have performed the experiment.**
- **Attach Data, Calculations, Results and the Answers of 'Questions for Discussions' parts to your previously submitted Answers of 'Questions on Theory' part to make the whole lab report.**
- **Finally, submit the lab report before you leave the lab.**

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Questions for Discussions

1) In this experiment why did you use a transformer? [0.5]

Ans: In this experiment we ~~a~~ use transformer as we can use the turn ratio of the transformer from the secondary and primary side. So, that's why we use a transformer to simplify the experiment and run the oscilloscope smoothly to get the prooper slope ~~of~~ in the oscilloscope screen.

2) You know the time base of the oscilloscope. How can you find out the line frequency, in a different way, by forming the transformer's output voltage vs. time graph without the help of any other alternating voltage of known frequency? [0.5]

Ans: we know,

$$T_B = \frac{1}{Df}$$

Where, f is the line frequency

If there are D number of division between two consecutive peak, D division represent an amount of time which is equal to the time period, $T = 1/f$ of the alternating input voltage signal.

Therefore, a ~~fia~~ signal division represents

$T/D = 1/Df$ amount of time.

3) In this experiment the Lissajous curves which you formed contained only loops in their pattern. However, while tuning the Frequency Control Knob of the function generator you must have seen curves of complex patterns like the following one (Figure 12)

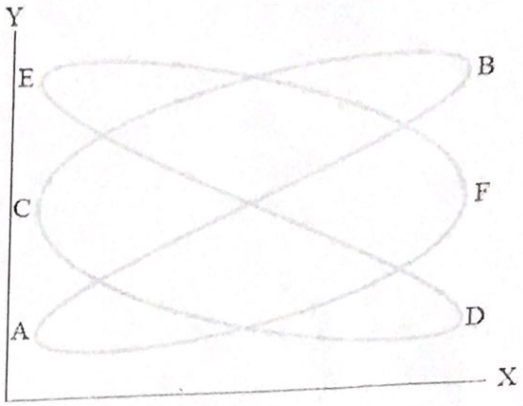

Figure 12: Figure for question 3

The bright spot is moving in the following order: A-B-C-D-E-F-A

What is T_x / T_y for this Lissajous curve? [1]

Ans:

$T_x / T_y = 1/3$

or, $T_y = 3$ here