EXPERIMENTAL PROBLEM 2

Black Box

Given a black box with two similar terminals. There are no more than three passive elements inside the black box. Find the values of elements in the equivalent circuit between the terminals. This box is not allowed to be opened.

Experimental Apparatus

1. Double channel oscilloscope with a panel illustration, showing the name and function of each knob

2. Audio frequency signal generator with a panel illustration, showing the name and function of each knob

3. Resistance box with a fixed value of l00 ohm($< \pm 0.5\%$)

4. Several connecting wires

5. For the coaxial cables, the wire in black color at the terminal is grounded.

6. Log-log paper, semi-log paper, and millimeter paper are provided for use if necessary

Note: The knobs, which were not shown on the panel illustration of the "signal generator" and "oscilloscope", have been set to the correct positions. It should not be touched by the student.

Experimental Requirements

1. Draw the circuit diagram in your experiment.

2. Show your measured data and the calculated results in the form of tables. Plot the experimental curves with the obtained results on the coordinate charts provided(indicate the title of the diagram and the titles and scale units of the coordinate axes)

3. Given the equivalent circuit of the black box and the names of the elements with their values in the equivalent circuit(write down the calculation formulas).

Instructions

1. Do your experiment in the frequency range between 100 Hz and 50kHz.

2. The output voltage of the signal generator should be less than 1.0V (peak-to-peak). Set the "Out Attenuation" switch to "20" db position and it should not be changed.

3. On connecting the wires, be careful to manage the wiring so as to minimize the 50Hz interference from the electric mains.

Instruction for Using XD2 Type Frequency Generator

1. Set the "Out Attenuation" to "20" db position and it should not be changed.

2. Set the "Damping Switch" to "Fast" position.

3. The indication of the voltmeter of the signal generator is the relative value, but not the true value of the output.

4. Neglect the error of the frequency readings.

Note: For XD22 Type Audio Frequency generator, there is no "Damping Switch", and the "output" switch should be set to the sine "$\sim$" position.

Instruction for Using SS-5702 Type Oscilloscope

1. Keep the "V mode" switch in "Dual" position.

2. The "Volts/div" (black) and the "variable control" (red) vary the gain of the vertical amplifier, and when the "variable control" (red) is ill the fully clockwise position, the black setting are calibrated.

3. The "Times/div" (Black) varies the horizontal sweep rate from 0.5 μs/div to 0.2s/div, and they are calibrated when the "variable control" (red) is in the fully

clockwise CAL position.

4. The “Trigging Source” (Trigging sweep signal) is used to select the trigging signal channel and the" level" control is used to adjust the amplitude of the trigging signal.

5. Measuring accuracy: ±4%.

Instruction for Using “Resistance Box”

The resistance of the “Resistance Box” has been set to a value of 100ohm, and it should not be changed.