LAB 1(b) –Instrumentation and Measurement

5.2 The Measurement of Voltage

1. Set the output of the function generator to 1 kHz, –2V to 2V triangle wave and connect to the chA (in DC mode) of the scope (x10).
2. Put four AA battery into the battery box, and connect to the chB (in DC mode) of the scope (x10).

4 x AA battery box

Q7. Show only the triangle wave on the scope, and capture it.
Q8. What is the frequency of the triangle wave measured in the scope?
Frequency = _____Hz

3. Use  function in the scope, and select the '**A - B**' option to do the subtraction operation.

Q9. Capture the resultant waveform.
Q10. What is the frequency of the resultant waveform? Frequency = _____Hz

5.3 The Measurement of AC Signal (rms value) using DMM

1. Use the scope (DC mode) to set the output of the function generator to 1kHz, –2V to 2V square wave.
2. Connect the DMM (in ACV mode) to the function generator and measure the voltage of the square wave.

Q11. What is $\mathbf{V_{DMM}}$ (square)? _____ V rms

3. Repeat step 1 and 2 with triangular wave and sine wave.

Q12. What is $\mathbf{V_{DMM}}$ (triangular)? _____ V rms
Q13. What is $\mathbf{V_{DMM}}$ (sine)? _____ V rms

4. Find the theoretical rms values for Part 2 and 3.

Q14. What is **V**(square)? _____ V rms
Q15. What is **V**(triangular)? _____ V rms
Q16. What is **V**(sine)? _____ V rms

5.4 Loading Effect

1. Connect the circuit as shown in Figure 4. V1 = ~6V, R1 = R2 = 510kΩ, R3 = R4 = 1kΩ .

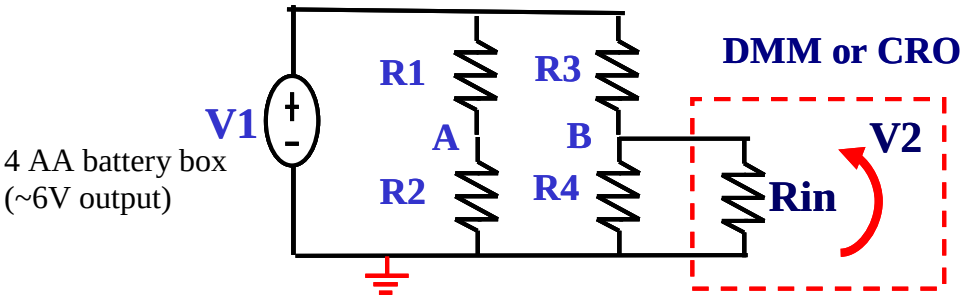

Figure 4

2. Use the DMM (in DCV mode) ($R_{in} \approx 10M\Omega$) to measure the voltage at node A and at node B.

Q17. What is V_A (DMM)? _____V
Q18. What is V_B (DMM)? _____V

3. Use the SCOPE with a direct (x1) probe ($R_{in} = 1M\Omega$) to measure the voltage at node A and at node B.

Q19. What is V_A (×1)? _____V
Q20. What is V_B (×1)? _____V

4. Use the SCOPE with an ×10 probe ($R_{in} = 10M\Omega$) to measure the voltage at node A and at node B.
(In the scope probe, turn the switch to ×10). Set the scope to ×10 mode also.

Q21. What is V_A (×10)? _____V
Q22. What is V_B (×10)? _____V

5. Explain briefly the results in step 2, 3 and 4.

Q23. Explain briefly the results in Step 2, 3, and 4.

5.5 Effect of limited bandwidth on instruments

1. Use the scope to set the output of the function generator to 100Hz, 4Vp-p (+/–2V) sine wave.
2. Use the DMM (in ACV mode) to measure the voltage of the function generator output (=$\mathbf{V_{DMM}}$).
3. Repeat step 1 and 2 with frequency = 100, 500, 1k, 1.2k, 1.4k, 1.6k, 1.8k, 2k, 2.2k, 2.4k, 2.6k, 2.8k, 3k, 3.5k, 4k, 5k, 6k, 7k, 8k, 9k, 10k

Q24. Sketch the V_{DMM} versus frequency results obtained in step 2 and 3. Use log scale for the frequency.

Q25. What is the estimated bandwidth of the DMM from the plot? _____Hz

Q26. Show all the circuits and waveform to TA.