Analog Electronic Circuits Lab (EC2.103, Spring 2024)

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Instructions:

1. Don't touch the primary side of the transformer when you are working with wall supply.
2. Please get verified your circuit by TAs or Instructors before connecting to the wall supply.
3. Systematically record all your observations in the lab book (mandatory)
4. Save results in USB or take pictures
5. Make meaningful tables to summarize your findings and show it to the instructor(s) during the lab session only
6. Bring your calculators and DMM (if available)
7. Handle equipment carefully and report in case of any incidence
8. Enjoy your time in lab and strengthen your understanding about circuits

Experiment-3
Full Wave Rectifiers

1. **Transformer Characterization**
   Fig. 1 shows electrical model of a center tapped transformer ($\frac{V_P}{V_S} = \frac{N_1}{N_2}, V_S = V_A - V_B, N_2 = N_{21} + N_{22}$). In this experiment you will characterize the given transformer.

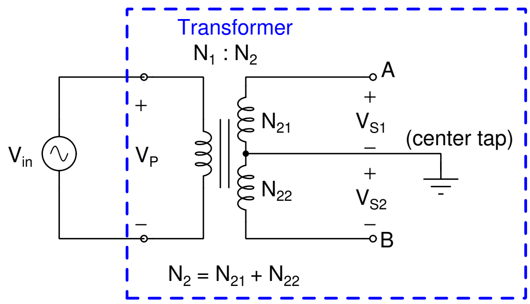


Figure 1: Bridge Rectifier

   (a) Apply V_{in} from function generator (amplitude 12 Vpp and 1 kHz), plot and report V_A and V_B on channel 1 and 2 of the DSO, respectively.

   (b) Report amplitude and phase difference between V_A and V_B and estimate $N_1 : N_2$.

   (c) Change frequency of V_{in} and report output amplitude V_A at channel-1. Report in the form of table for 10 kHz, 50 kHz, 100 kHz, 1 MHz, 5 MHz, 10 MHz and 20 MHz.

   (d) Do you observe reduction in amplitude with increase in frequency? What could be the probable cause? Plot V_P on channel-2 and repeat above experiment. Do you observe any reduction in input side too? If yes, what could be the reason? *(Hint: the input cable has a limited bandwidth)*

   (e) Report the -3 dB bandwidth of the cable used to connect function generator output to transformer input? Attach input output plots, clearly mark amplitude and frequency.

2. **Full Wave Rectifier (FWR) using center tap transformer and two diodes**

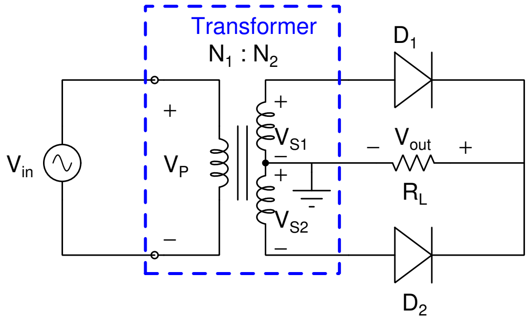


Figure 2

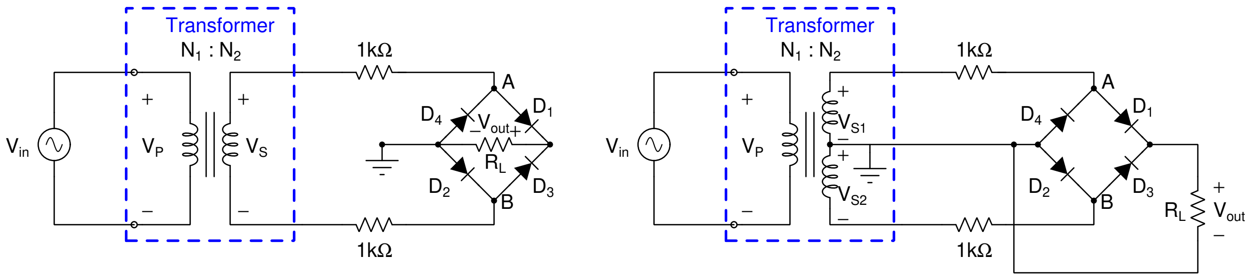
(a) Connect the circuit as shown in the figure 2 and apply V_{in} from function generator (amplitude 12 Vpp and 1 kHz), $R_L = 50\ k\Omega$.

(b) Plot V_{S1} and V_{out}. Do you observe full wave rectification. Report your plots by clearly marking amplitudes.

(c) Report peak current flowing through R_L ($I_L = V_{out}/R_L$).

(d) Do you observe a significant reduction in V_{out} amplitude for this experiment? If yes, then what could be the reason? *(Hint: Diodes might not be able to completely turn on and forward current is too less)*. How will you verify your hypothesis? *(Hint: from diode characterization, you know what is the forward bias current through diode.)*

3. **Bridge rectifier for full wave rectification**



(a) (b)

Figure 3

A FWR can also be realized without needing a center tap transformer. Fig. 3(a) shows the bridge rectifier, which does not require a center tap transformer but need 4 diodes. In our lab, we have center tap transformers. Therefore, to build the bridge rectifier connect the circuit as shown in Fig. 3(b). As shown in the figure signals at node A and B are equal and opposite and are eventually applied across the bridge resulting into FWR circuit.

(a) Apply V_{in} from function generator (amplitude 12 Vpp and 1 kHz), $R_L = 50\ k\Omega$.

(b) Repeat steps (b), (c) and (d) of the previous experiment.

(c) Now replace V_{in} with the wall supply and plot the amplitude of the signal at secondary side of the transformer.

(d) Plot FWR output (V_{out}) for the wall supply. Do you observe better signal levels at V_{out} as compare to the previous case when function generator was used as input source. Explain why they are different. *(Hint: With wall supply, voltage at secondary is large, which allows diodes to conduct fully in forward bias condition.)*