TITLE : DIODE CHARACTERISTICS

OBJECTIVE :1. To determine the characteristics of a semiconductor diode.
2. To investigate the function of diodes in half wave and full wave rectifier circuits.

PART 1 : DIODE CHARACTERISTICS

APPARATUS : List the apparatus as you find in the practical in the worksheet. (Diode given for the experiment is 1N4001. Refer the data sheet for specifications).

PROCEDURE : The circuit arrangement shown in Fig.1 is used to measure the volt-ampere characteristics of any two terminal non-linear terminal device.

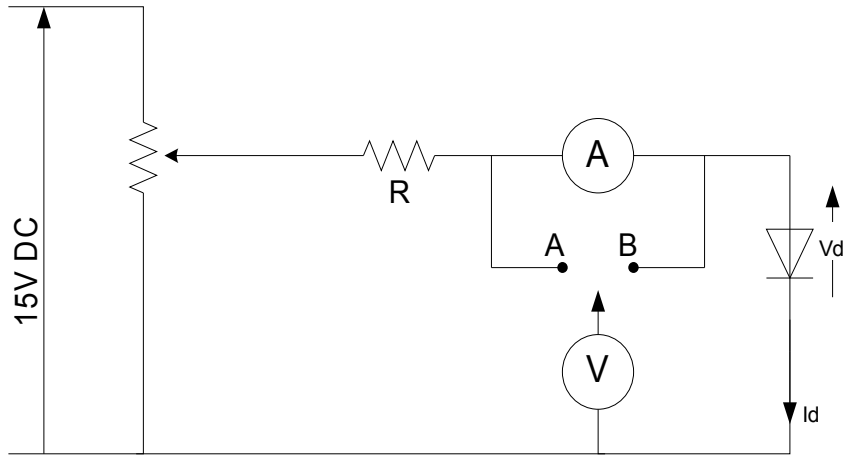


Figure 1. Diode characteristics test circuit

If the position A is used, the Voltmeter reads the total voltage drop across the ammeter and the diode, whereas the ammeter reads the true currant through the diode. If the position B is used, ammeter reads the current through the diode and voltmeter.

1. what is the purpose of R, in this circuit ? Comment about the value R required.

2. Under the reverse biased condition what is the most suitable circuit arrangement? Explain your answer.

3. Connect the circuit Diagram with the diode Forward biased.

4. Obtain the current reading, by applying a voltage of 0 to 0.7V in 0.1 V steps. Beyond 0.7 V obtain voltmeter readings for steps of 10mA till maximum current reading is 100mA.

PART 2 : FULL BRIDGE DIODE RECTIFIER

OBJECTIVE : To study the load characteristics of full bridge diode rectifier.

APPARATUS : Multimeter (Analog or Digital)
Transformer, 12V ac center tapped (6-0-6 is available)
Oscilloscope
Resistors – 1kΩ ,500 Ω

PROCEDURE :

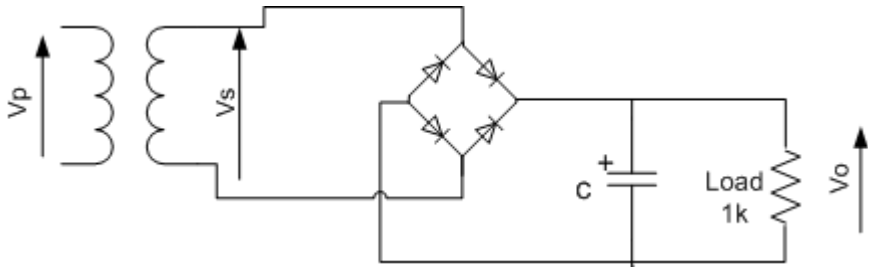


Figure 3. Full bridge diode rectifier circuit

1. Assemble the circuit omitting the capacitor. Estimate the peak voltage of V_s and check for the Peak Inverse Voltage (PIV) rating of the diodes. Observe and sketch V_o. Find the peak value of the load voltage from the oscilloscope trace.

2. Using a Multimeter measure the ac (rms) voltage across the secondary winding of the transformer.

3. Measure the average value of the load voltage (V_o) by using a Multimeter (for this measurement a dc voltage range should be used).

4. Connect a 470 μF capacitor to the circuit. (**Note: It is important that the polarity marking of the electrolytic capacitor corresponds to the polarity of its terminal voltage.**) By using the oscilloscope with ac coupling observe and sketch the ripple voltage of V_o . Find the peak to peak ripple voltage.

5. Change the load resistor to 500 Ω and repeat part 4. Observe the effect of connecting a second 470 μF capacitor in parallel. (**First make sure that the first capacitor is fully discharged.**)

6. a. Calculate the voltage drop across a diode while conducting.

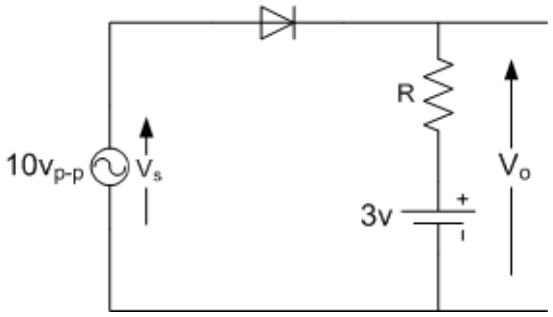
   b. Calculate the theoretical avarage and the peak to peak value of V_o.

PART 3: DIODE APPLICATION – CLIPPING AND CLAMPING CIRCUITS

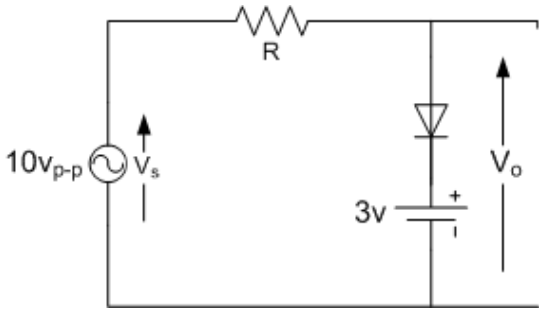
THEORY : There are various networks that have the ability to clip-off a portion of the input signal without distorting the remaining part of the input signal. They are used as voltage/current limiters or slicers. A clipping requires a minimum of one diode (either in parallel or series) and one resistor. A power supply is often used to set the various clipping levels.

PROCEDURE :

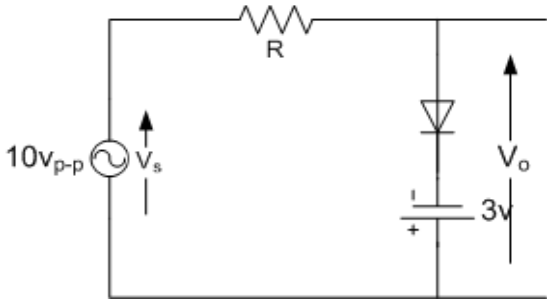
1. Rig up the circuits as per the circuit diagrams. Assume R=1 kΩ and V_γ = 0.7 v for the diodes.
2. For circuit 5 and 6 calculate time constant, hence select R1.
3. Set input signal to a 10 V_{p-p},1 kHz sinusoidal signal using the signal generator.
4. Observe the waveforms of V_o using CRO (with DC coupling)
5. Sketch all the waveforms in a graph sheet to the same scale.



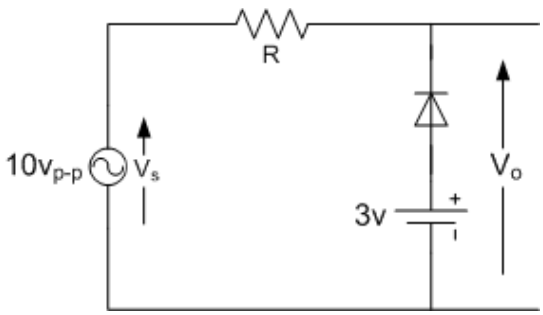
Circuit 1



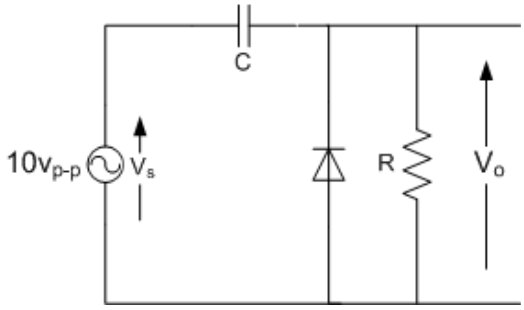
Circuit 2



Circuit 3



Circuit 4



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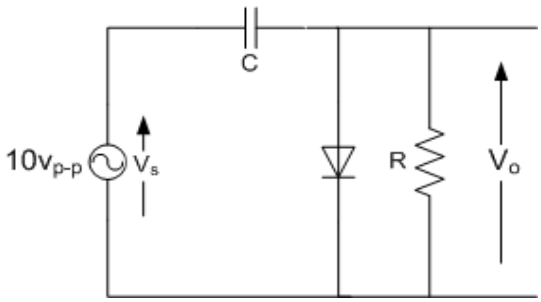

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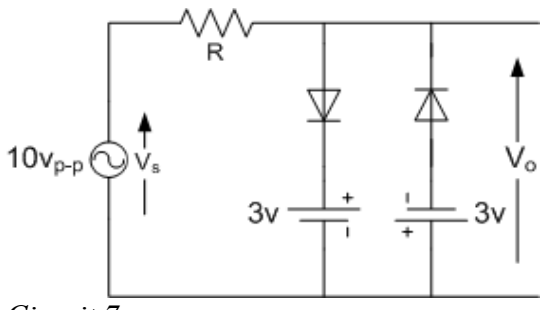
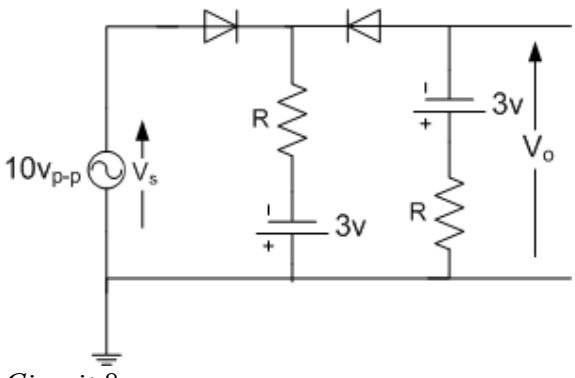


Circuit 7



Circuit 8