MA'DIN POLYTECHNIC COLLEGE

For Semester II
Basic Electronics Lab (301)

For CT only

Practical

301

Department of Electrical and Electronics Engineering

MEASUREMENT OF RESISTANCE OF CARBON RESISTORS

AIM

1. To identify resistor values and tolerances from the color code and multimeter measurement.
2. To compare the color coded resistor value with the actual measured resistance value (by multimeter or ohmmeter).

COMPONENTS REQUIRED

Sl no	Components	Specification	Quantity
1	Resistor	-	Any five with different value
2	Multimeter	0-100kΩ	1 No.

THEORY

Since it is not practical to print the resistance values on the resistors due to its small size, therefore a method called color coding is adopted.

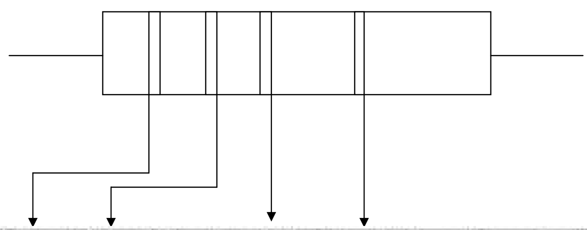
The resistor values are generally printed on the body of bigger resistors like wire wound and metal film type resistors, but for the carbon resistors the values are color coded since its size is too small to print the value directly on the body of resistor. Colour coding is standardized by Electronic Industries Association(EIA). Coloured bands are marked on the surface of the resistors from one end. The I^st band gives the first significant digit, II^nd band gives second significant digit of the resistance value, III^rd band is the multiplier and IV^th band represents the tolerance in percentage.

PROCEDURE

1. Hold the resistor so that the colour band are at the left end of the resistor . write down the numerical value of first colour band
2. Write down the numerical value of the second colour band at the right side of first numeric
3. Read the numerical value of third colour band and write down those many zeros at the right side of the first two numeric
4. Write down the tolerance in percentage on right side of above numerical values
5. Measure the actual resistance using multimeter or ohm meter. Compare the colour code value with multimeter reading.
6. Repeat the procedure for various resistors

TABULATION

Sl No	First digit	Second digit	Third digit	Tolerance	Resistance value	Multimeter reading



Color	1st band	2nd band	3rd band (multiplier)	4th band (tolerance)	Temp. Coefficient
Black	0	0	$\times 10^0$		
Brown	1	1	$\times 10^1$	±1% (F)	100 ppm
Red	2	2	$\times 10^2$	±2% (G)	50 ppm
Orange	3	3	$\times 10^3$		15 ppm
Yellow	4	4	$\times 10^4$		25 ppm
Green	5	5	$\times 10^5$	±0.5% (D)	
Blue	6	6	$\times 10^6$	±0.25% (C)	
Violet	7	7	$\times 10^7$	±0.1% (B)	
Gray	8	8	$\times 10^8$	±0.05% (A)	
White	9	9	$\times 10^9$		
Gold			$\times 10^{-1}$	±5% (J)	
Silver			$\times 10^{-2}$	±10% (K)	
None				±20% (M)	

RESULT

Measured the resistance value using colour code and compared it with multimeter reading.

2

CHARACTERISTICS OF P-N JUNCTION DIODE

AIM

To determine the forward characteristics of a p-n junction diode and determine the static and dynamic resistance.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30V	1 NO
2	VOLTMETER	0-20V	1 NO
3	AMMETER	0-100 µA	1 NO
4	ZENER DIODE	5.6 V	1 NO
5	RESISTOR	1KΩ	1 NO
6	POTENTIOMETER	1KΩ	1 NO
7	BREAD BOARD		1NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

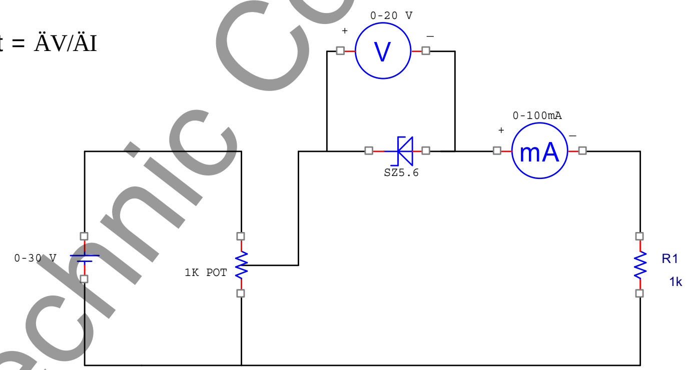
When a P type and N type semiconductors are joined together, a junction diode is created .It has a unique ability to permit current only in one direction. The lead connected to P type is called anode and the lead connected to N type is called cathode.If the anode of the diode is connected to the +ve terminal of a battery and cathode to the –ve terminal,the set up is called forward bias.the diode does not pass any current till the battery voltage exceeds the potential barrier (o.7 V for Si & 0.3 V for Ge). Once the battery potential exceeds the barrier potential high forward current in the order of mA flows through the diode due to the movements of hole and electrons.

The static resistance or DC resistance is the ratio of DC voltage across the diode to the DC current flows through it. Dynamic resistance or AC resistance of the diode at any point is the reciprocal of the slope of the charaecteristic at that point.

ie dynamic resistance= change in voltage/ change in current = ÄV/ÄI

PROCEDURE

1. Set up the circuits as shown in figure on bread board.
2. Switch on the power supply
3. Varying the voltage across the diode in steps and find corresponding current.
4. Repeat the above steps for different values of voltage



TABULATION

V in volt	I in mA

RESULT

Plotted the forward characteristics of PN junction Si diode and its

Static resistance =…………….

Dynamic resistance =………….

V-I CHARACTERISTICS OF ZENER DIODE

AIM

To plot VI characteristics of a zener diode and determine the breakdown voltage (V_{BR}) and dynamic resistance.

COMPONENTS AND EQUIPMENTS REQUIRED

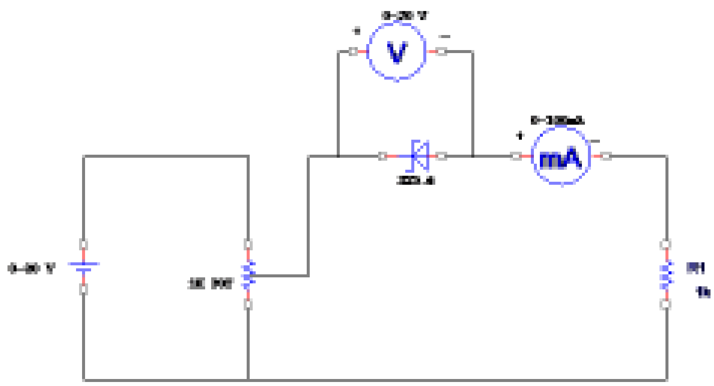
SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30V	1 NO
2	VOLTMETER	0-20V	1 NO
3	AMMETER	0-100 µA	1 NO
4	ZENER DIODE	5.6 V	1 NO
5	RESISTOR	1KΩ	1 NO
6	POTENTIOMETER	1KΩ	1 NO
7	BREAD BOARD		1NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

An ordinary diode will not permit current when it is reverse biased. If the reverse biased voltage exceed the peak inverse voltage rating diode may get destroyed, due to avalanche break down. Zener diodes are special kind of diode designed to operate in the break down region without causing the damage to them. when diode is heavily doped its depletion layer become very narrow. When the applied reverse bias voltage across the diode is increased, the electric field across the depletion layer becomes more intense and electrons get pulled out from the covalent bond, generating electron-hole pairs. Thus heavy reverse current flows. This phenomenon is called zener breakdown.

PROCEDURE

- Wire the circuit as shown in fig. after testing the component.
- Vary the input voltage and note down the ammeter and voltmeter readings and enter it in the tabular column.
- Calculate the dynamic zener resistance.



TABULATION

V in volt	I in mA

RESULT

Plotted the VI characteristics of Zener diode and its

Break down voltage (V_{BR}) = ……………

Dynamic resistance = …………

HALFWAVE RECTIFIER

AIM

To study the characteristics of a half wave rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	0-12V	1 NO
2	DIODE	IN 4001	1 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 µF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

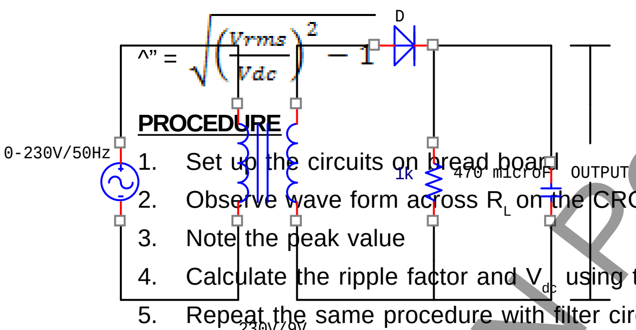
THEORY

A rectifier converts AC to pulsating DC by eliminating the negative half cycle of the input voltage . During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode is forward biased and hence it conducts and out put voltage is equal to input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode is reverse biased and hence it does not conduct and out put voltage is equal to zero. $V_{rms} = V_m/2$ $V_{dc} = V_m/\pi$

Ripple factor= Ripple voltage/dc voltage

$$\gamma = \sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$$



PROCEDURE

1. Set up the circuits on bread board
2. Observe wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of half wave rectifier.

Theoretical value of ripple factor =………..

Practical value of ripple factor =……………

Difference between Theoretical value and Practical value =………..

CENTRE TAPPED RECTIFIER

AIM

To study the characteristics of a centre tapped rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	9-0-9V	1 NO
2	DIODE	1N 4001	2 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 µF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

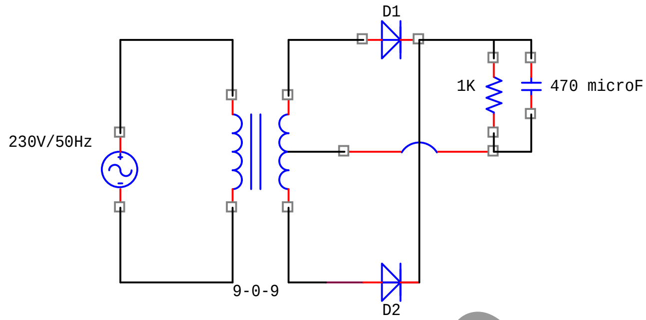
A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 is forward biased and diode D_2 is reverse biased .Therefore D_1 conducts and out put voltage is equal to input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode D_1 is reverse biased and diode D_2 forward biased, hence it conducts and output voltage is same as that of positive half cycle.

$V_{rms} = V_m/\sqrt{2}$ $V_{dc} = 2V_m/$“

Ripple factor = Ripple voltage/dc voltage

^” = $\sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$



PROCEDURE

1. Set up the circuits on bread board
2. Observe the transformer secondary voltage(V_{ac}) and wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of centre tapped rectifier.

Theoretical value of ripple factor =………..

Practical value of ripple factor =……………

BRIDGE RECTIFIER

AIM

To study the characteristics of a centre tapped rectifier.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	TRANSFORMER	0-12V	1 NO
2	DIODE	IN 4001	4 NO
3	RESISTOR	1KΩ	1 NO
4	CAPACITOR	470 µF , 25 V	1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 and D_3 are forward biased and diode D_2 and D_4 are reverse biased .Therefore diode D_1 and D_3 conducts and out put voltage is equal to the input voltage.

During negative half cycle of the input voltage, upper end of the secondary of the transformer is negative and lower end is positive. Therefore the diode D_1 and D_3 are reverse biased and diode D_2 and D_4 are forward biased, hence it conducts and out put voltage is same as that of positive half cycle.

$V_{rms} = V_m/\sqrt{2}$ $V_{dc} = 2V_m/$“

Ripple factor= Ripple voltage/dc voltage

^” = $\sqrt{\left(\frac{Vrms}{Vdc}\right)^2 - 1}$

PROCEDURE

1. Set up the circuits on bread board
2. Observe the transformer secondary voltage(V_{ac}) and wave form across R_L on the CRO.
3. Note the peak value
4. Calculate the ripple factor and V_{dc} using the equations.
5. Repeat the same procedure with filter circuit.

RESULT

Studied the characteristics of bridge rectifier.

Theoretical value of ripple factor =………..

Practical value of ripple factor =……………

Difference between Theoretical value and Practical value =………..

CLIPPING CIRCUITS

AIM

To set up different clipping circuits using diode and observe the waveform.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	DIODE	IN 4001	1 NO
2	RESISTOR	3.3KΩ	1 NO
3	FUNCTION GENERATOR		1 NO
4	BREAD BOARD		1 NO
5	CONNECTING WIRES		AS REQUIRED

THEORY

The property of diode as a switching device is utilized in in clipping circuit. They are useful to clip off positive or negative portion of the input waveform.

POSITIVE CLIPPER

This circuits passes only negative going half waves of the input to the out put. All the positive half cycles are bypassed through the diode since the diode gets forward biased when the input voltage become positive. Due to the voltage drop across the diode clipping occurs exactly at + 0.6V.

NEGATIVE CLIPPER

This circuits passes only positive going half waves of the input to the out put. All the negative half cycles are bypassed through the diode since the diode gets forward biased when the input voltage become negative. Due to the voltage drop across the diode clipping occurs exactly at - 0.6V.

PROCEDURE

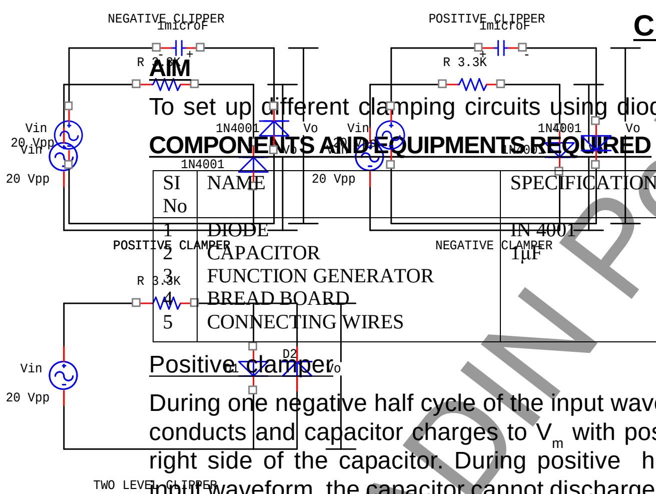
1. Set up the circuit and the signal generator in sine wave mode and fix the amplitude at 20 Vpp connecting directly with CRO

2. Connect the signal generator out put to the input of the circuit.

3. Observe the clipped wave form on CRO screen

RESULT

Observed and plotted the clipped waveform.



CLAMPING CIRCUITS

AIM

To set up different clamping circuits using diode and observe the waveform.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	DIODE	IN 4001	1 NO
2	CAPACITOR	1µF	1 NO
3	FUNCTION GENERATOR		1 NO
4	BREAD BOARD		1 NO
5	CONNECTING WIRES		AS REQUIRED

THEORY

At some situations it is necessary to add subtract a dc voltage to a given wave without changing the shape of waveform. Circuit used for this purpose is called clamper. The clamping level can be made at any voltage level by biasing the diode. Such a circuit is called biased clamper.

Positive clamper

During one negative half cycle of the input waveform the diode conducts and capacitor charges to V_m with positive polarity at right side of the capacitor. During positive half cycle of the input waveform, the capacitor cannot discharge since the diode does not conduct. Thus capacitor act as a dc voltage source of V_m volts in series with the input signal voltage V_m .The output voltage then can be expressed as

$V_0 = V_m + V_m$

Negative clamper

During one positive half cycle of the input waveform the diode conducts and capacitor charges to V_m with negative polarity at right side of the capacitor. During negative half cycle of the input waveform, the capacitor cannot discharge since the diode does not conduct. Thus capacitor act as a dc voltage source of —V_m volts in series with the input signal voltage $-V_m$ .The output voltage then can be expressed as

$V_0 = -V_m + -V_m$

PROCEDURE

1. Set up the circuit and the signal generator in sine wave mode and fix the amplitude at 20 Vpp connecting directly with CRO

2. Connect the signal generator out put to the input of the circuit.

3. Observe the clamper waveform on CRO screen

RESULT

Observed and plotted the clipped waveform

VOLTAGE DOUBLER

AIM

To set up study voltage doubler circuit.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	DIODES	IN 4001	2 NOS
2	CAPACITOR	100µF	2 NOS
3	VOLTMETER	0-30V	1 NO
4	FUNCTION GENERATOR		1 NO
5	BREAD BOARD		1 NO
6	CONNECTING WIRES		AS REQUIRED

THEORY

The circuit of a voltage doubler is shon in figure. During the positive half cycle of the input voltage , the diode D_1 conducts and D_2 does not conduct and capacitor C_1 charges to peak value V_m. During the negative half cycle of the input voltage the diode D_2 conducts and D_1 does not conducts and capacitors C_2 charges to peak value V_m. Since capacitors C_1 and C_2 are in series out put voltmeter reads 2 V_m .

PROCEDURE

1. After checking the components using multimeter, connections are made as per diagram.
2. Switch on the power supply.
3. Take the reading of input ac voltage, voltage across C_1 and C_2 and out put voltage.

RESULT

Studied and verified the voltage doubler circuit.

COMMON EMITTER TRANSISTOR CHARACTERISTICS

AIM:

To plot the VI characteristics of common emitter configuration of a given transistor and plot the DC load line.

COMPONENTS AND EQUIPMENTS REQUIRED

SI No	NAME	SPECIFICATION	QUANTITY
1	POWER SUPPLY	0-30 V	2 NOS
2	VOLTMETER	0-10V, 0-30V	1 EACH
3	AMMETER	0-100 mA, 0-100 µA	1 EACH
4	TRANSISTOR	BC 107	1 NO
5	RESISTOR	1.5 KΩ	1 NO
6	POTENTIOMETER	1 KΩ	2 NOS
7	BREAD BOARD		1 NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

A transistor is a 3 terminal active device. The 3 terminals are emitter(E),base(B)and collector(C).In CE configuration we make the emitter common to both input and output for normal operation.The base-emitter junction is forward biased and collector-emitter junction is reverse biased.

The input characteristics is plotted between input current(I_B) and the input voltage(V_{BE}) with keeping output voltage (V_{CE}) constant. The input dynamic resistance r_i is calculated using the equation

r_i= ÄV_{BE}/ÄI_B , keeping V_{CE} is constant.

The output characteristics is plotted between output current(I_C) and the output voltage(V_{CE}) with keeping input current (I_B)constant. The output dynamic resistance r_0 is calculated using the equation

r_o= ÄV_{CE}/ÄI_C , keeping I_B is constant.

PROCEDURE

For input characteristics

1. Check the transistor using multimeter. Switch on the power supply keeping rheostat at minimum position. Switch off the collector to emitter power supply.
2. Note down the base current for different values of $V_{BE.}$
3. Repeat the step 2 for different values of V_{CE} , say 3V, 6V.
4. Draw the characteristics on a graph sheet and calculate dynamic input resistance.

For out put characteristics

1. Check the transistor using multimeter. Switch on the power supply keeping rheostat at minimum position. Switch off the base to emitter power supply.
2. Note down the collector current for different values of $V_{CE.}$
3. Repeat the step 2 for different values of base current , say 80ìA, 100ìA.
4. Draw the characteristics on a graph sheet and calculate dynamic out put resistance.

TABULATION

Input characteristics

V_{CE} = 0V		V_{CE} = 3V		V_{CE} = 6V	
I_B	$V_{BE.}$	I_B	$V_{BE.}$	I_B	$V_{BE.}$

Out put characteristics

I_B = 60µA		I_B = 80µA		I_B = 100Ma	
I_C	$V_{CE.}$	I_C	$V_{CE.}$	I_C	$V_{CE.}$

RESULT

Plotted the input and out put characteristics of a CE transistor.

Dynamic input resistance = ……………

Dynamic out put resistance = ……………