ELECTRICAL TECHNOLOGY LAB-320

SEMESTER 3

OMEASUREMENT 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.

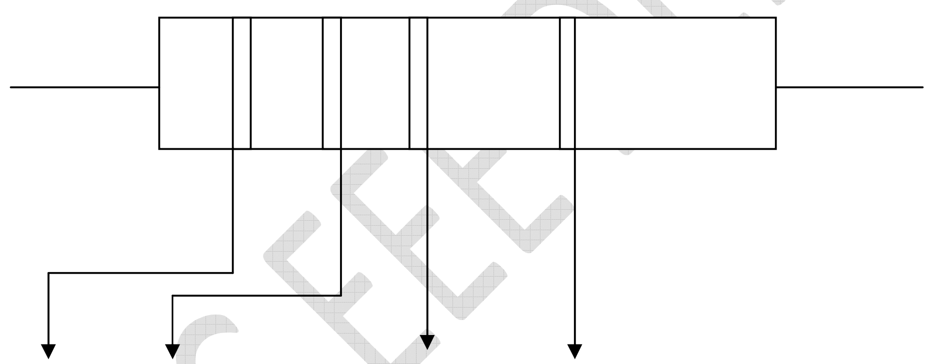
The resistor values are generally printed on the body of bigger resistors like wire wound and metal film type resistors, but for the carbon resistors the values are color coded since its size is too small to print the value directly on the body of resistor. Colour coding is standardized by Electronic 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	1^{st} band	2^{nd} band	3^{rd} band (multiplier)	4^{th} band (tolerance)	Temp. Coefficient
Black	0	0	$\times10^0$		
Brown	1	1	$\times10^1$	±1% (F)	100 ppm
Red	2	2	$\times10^2$	±2% (G)	50 ppm
Orange	3	3	$\times10^3$		15 ppm
Yellow	4	4	$\times10^4$		25 ppm
Green	5	5	$\times10^5$	±0.5% (D)	
Blue	6	6	$\times10^6$	±0.25% (C)	
Violet	7	7	$\times10^7$	±0.1% (B)	
Gray	8	8	$\times10^8$	±0.05% (A)	
White	9	9	$\times10^9$		
Gold			$\times10^{-1}$	±5% (J)	
Silver			$\times10^{-2}$	±10% (K)	
None				±20% (M)	

RESULT

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

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 mA	1 NO
4	DIODE	IN 4001-Si OR OA 79-Ge	1 NO
5	RESISTOR	1KΩ	1 NO
6	POTENTIOMETER	1KΩ	1 NO
7	BREAD BOARD		1NO
8	CONNECTING WIRES		AS REQUIRED

THEORY

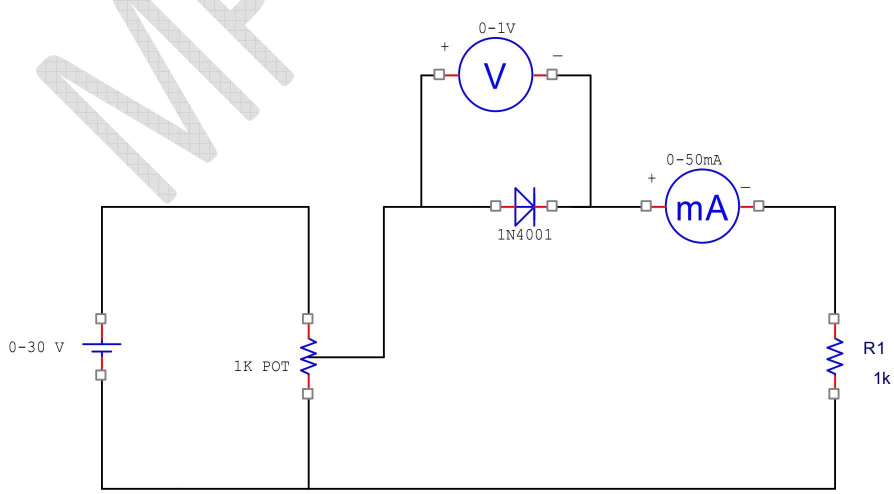
When a P type and N type semiconductors are joined together, a junction diode is created .It has a unique ability to permit current only in one direction. The lead connected to P type is called anode and the lead connected to N type is called cathode.If the anode of the diode is connected to the +ve 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 = $\Delta V/\Delta I$

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 =………….

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

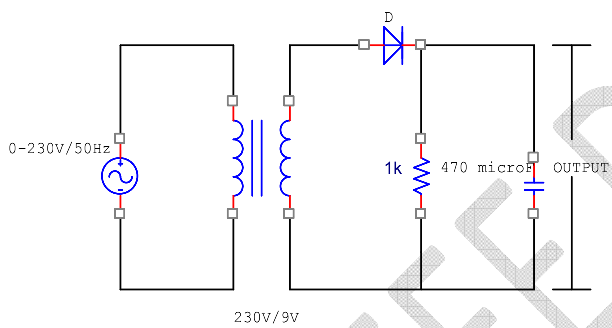
A rectifier converts AC to pulsating DC by eliminating the negative half cycle of the input voltage . During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode is forward biased and hence it conducts and out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

$$V_{rms} = V_m /2 \qquad V_{dc} = V_m / \prod$$

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

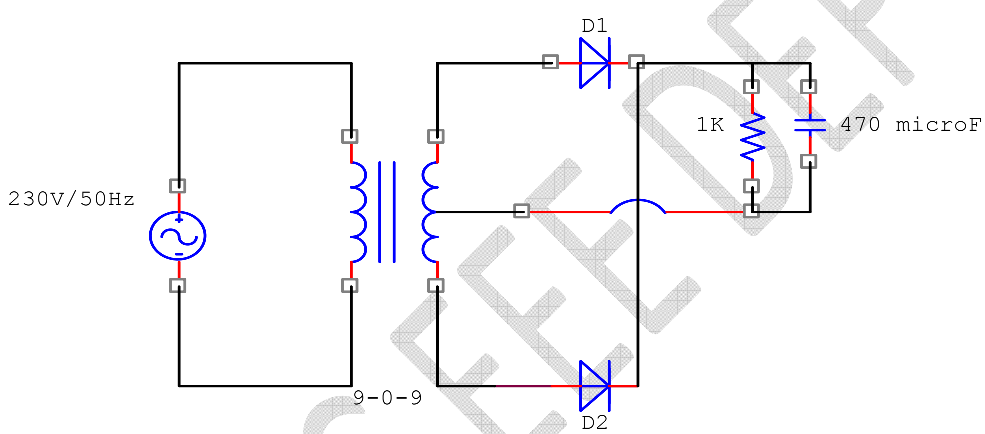
A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 is forward biased and diode D_2 is reverse biased .Therefore D_1 conducts and out put voltage is equal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

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

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

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

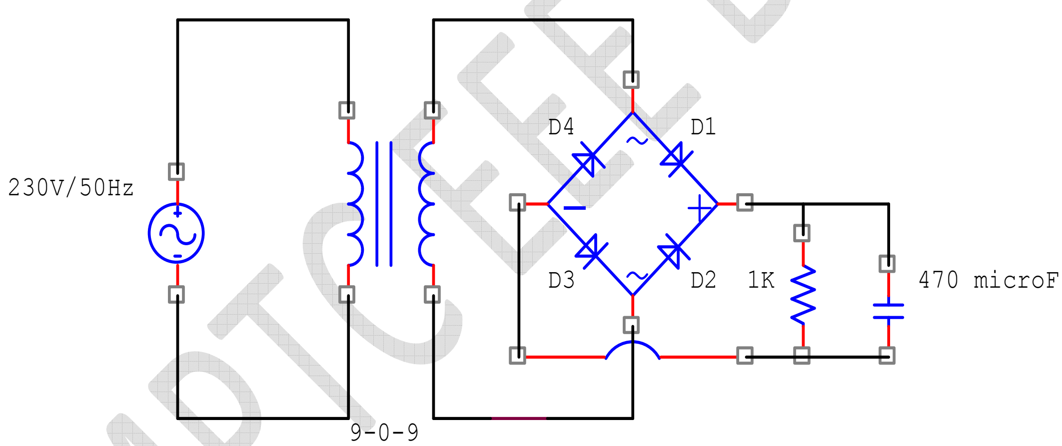
A rectifier converts AC to pulsating DC.During positive half cycle of the input voltage, upper end of the secondary of the transformer is positive and lower end is negative. Therefore the diode D_1 and D_3 are forward biased and diode D_2 and D_4 are reverse biased .Therefore diode D_1 and D_3 conducts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

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

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 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 =………...

FAMILIARISATION OF LOGIC GATES

AIM

Familiarization of logic gates and to verify the truth table for different Ices.

COMPONENTS AND EQUIPMENTS REQUIRED

Digital trainer kit, digital IC tester,IC 7432,7408,7404,7402,7400,7486 and connection wires.

THEORY

The logic functions frequently involved in the design of digital systems are AND,OR,NAND,NOR,NOT and EX-OR.NOT circuit performs a logical invertion. The AND gate performs a logical multiplication..The NAND gate is a contraction of NOT-AND and implies a NAND function with a complimented output. The NOR gate is a contraction of NOT-OR and implies a NOR function with a complimented output. The EX-OR gate is widely used logic function for special arithmetic operations. In this if any one of the input is high output also high.

PROCEDURE

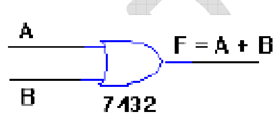
1.check the IC using a digital IC tester.
2.place the IC on the kit and switch on the kit.
3.check the output by applying different combination of input.
4.repeat the procedure for all the given Ices.

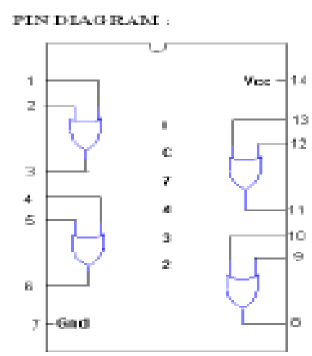
RESULT

Familiarized the logic gates and verified the truth table for different Ices.

OR GATE

SYMBOL

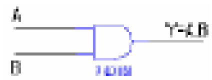


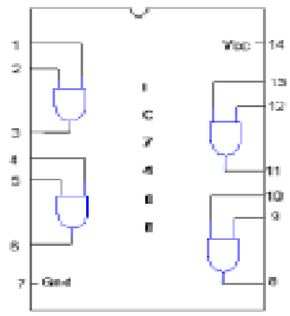


TRUTH TABLE

A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

AND GATE

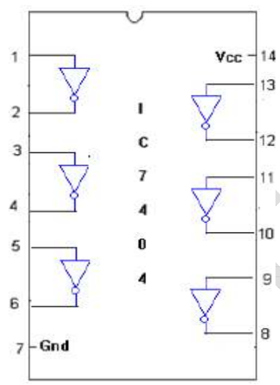




TRUTH TABLE

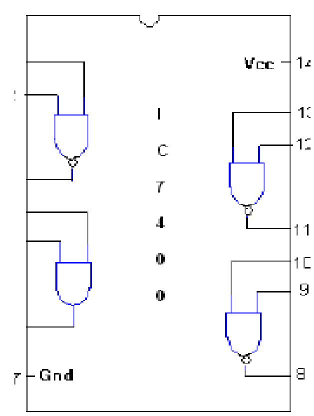
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

NOT GATE

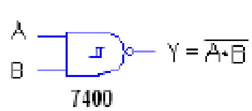


A	$\overline{A}$
0	1
1	0

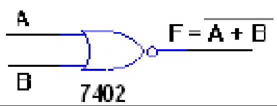
<u>NAND GATE</u>



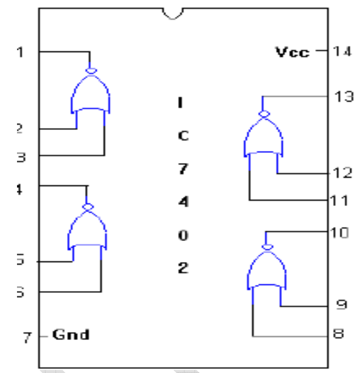
A	B	$\overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0



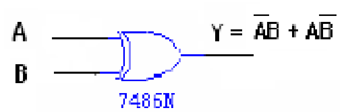
NOR GATE



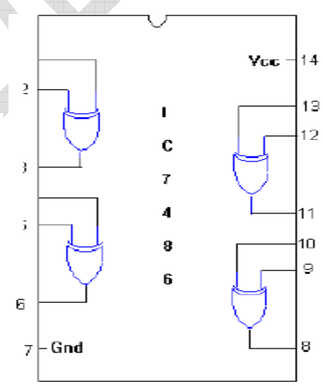
A	B	$\overline{A+B}$
0	0	1
0	1	1
1	0	1
1	1	0



EX-OR GATE



A	B	$\overline{A}B + A\overline{B}$
0	0	0
0	1	1
1	0	1
1	1	0



5..MEASUREMENT OF LOW AND MEDIUM RESISTANCE

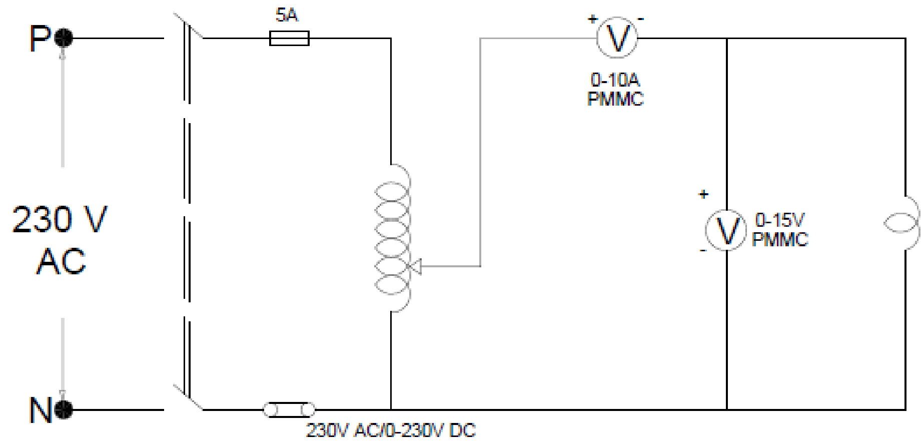
Aim: - To measure the low and medium resistance by Voltmeter – Ammeter method

Apparatus:

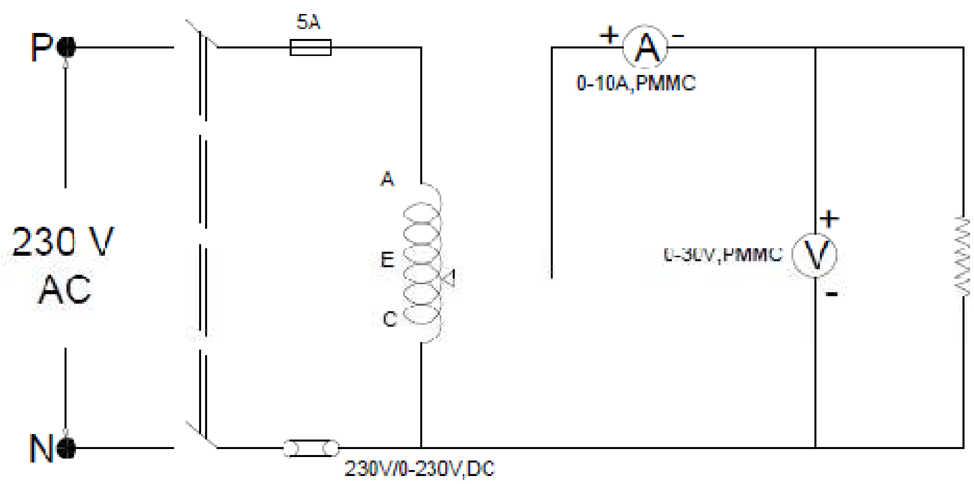
Principle: According to Ohm`s law, the current flo2wing through a circuit is directly proportional to the potential difference between it, provided the temperature is kept constant.
I.e., V ∝ I., V= IR., Or R= V/I. The unit of resistance is OHM (Ω).
Resistances are classified into three.—1) Low resistance. (0 - 1Ω)
2) Medium resistance (1- 100 KΩ)

3) High resistance (Above 100 K Ω)

LOW RESISTANCE MEASURMENT



MEASURMENT OF MEDIUM RESISTANCE



<u>Procedure</u>: - Low resistance measurement :

1. Connected the circuit as in connection diagram (1) and checked it .
2. Given the supply from low voltage, high current source.
3. Then varied the rheostat from maximum position to minimum and taken the corresponding V/m readings and A/m readings for each variation.
4. In each case find out the resistance by the formula R= V/I
5. Find the mean value of all resistance to get the value of low resistance.

Medium resistance:-

1. 1Connected the circuit as in connection diagram (1) and checked it.
2. Given the supply from high voltage, low current source .
3. Then varied the rheostat from minimum out put position to maximum out put and taken the corresponding V/m readings and A/m readings for each variations .
4. In each case find out the resistance by the formula R= V/I

Find the mean value of all resistance to get the value of medium resistance;

Result: 1) Low resistance=

2) Medium resistance=

Low resistance.

Sl No	A/m reading	V/m reading

Medium resistance

Sl No	A/m reading	V/m reading

.OPEN CIRCUIT TEST OF TRANSFORMER

AIM:-

To conduct a open circuit test in given transformer. Predetermine the Ro&Xo

MACHINE DETAILS:-

METERIALS REQUIRED:-

1. **Ammeter (0-5A) MI 1NO**
2. **Voltmeter (0-250v) MI 1NO**
3. **Wattmeter (300v,15A,lpf) 1NO**

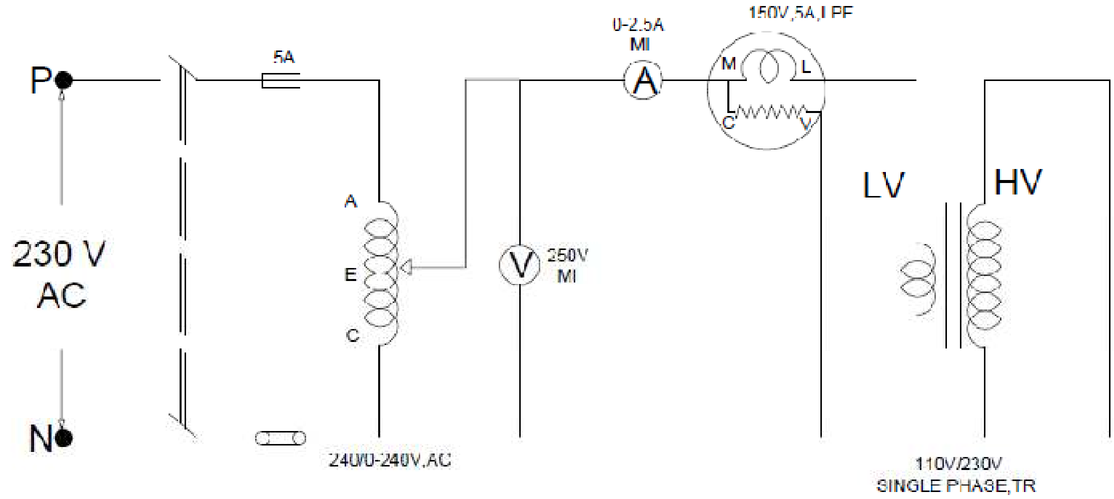
THEORY:-

The purpose of the OC test to determine the no load loss (core loss) at rated voltage and frequency. Shunt branch parameters of equalent circuit r0&x0 and the no load current of the transformer on winding of the transformer. In the open circuit test the primary load current is very small(2.6 of rated current)copper loss is negligibly small in the primary and is nil in the secondary is opened. The equalent circuit parameters r0&xo referred to LV side can be calculated from the test result.

The no load power loss, $P_i=V_0*I_0*\cos\phi_0$

$\cos\phi_0=P_i/V_0*I_0$

OC TEST



PROCEDURE:-

1. Collect the materials for the given work.

2. Connection are done as shown in connection diagram.

3. Keep auto transformer at zero position.

4. Adjust the auto transformer up to rated voltage.

5. Take voltmeter, ammeter and wattmeter reading.

V_{OC}	I_{OC}	W_{OC}

MODEL CALCULATION

V_{OC}=

I_{OC}=

W_{OC}=

$W_{OC=}$=$V_{OC}\,I_{OC}\,COS\emptyset_0$

$\emptyset_0$=$cos^{-1}(\frac{W_{OC}}{V_{OC}\,I_{OC}})$

Wattles component $i_w = i_0 cos\emptyset_0$

Magnetizing component $i_\mu = i_0 sin\emptyset_0$

R_0=$\frac{V_{OC}}{I_W}$ $R_{0'}$=$\frac{R_0}{K^2}$

X_0=$\frac{V_{OC}}{I_\mu}$ $X_{0'}$=$\frac{X_0}{K^2}$

RESULT:-

1) **Equivalent circuit of single phase transformer was plotted.**
2) **Efficiency curve were plotted.**
3) **Regulation curve were plotted.**
4) **Value of max. efficiency =…………………………….**
5)

.SHORT CIRCUIT TEST OF A TRANSFORMER

AIM:-

To conduct a short circuit test in given transformer. Determine the efficiency and regulation for different load .plot the following graphs

1. **Efficiency vs out put**
2. **%regulation vs p f**
3. **Predetermine max efficiency**

MACHINE DETAILS:-

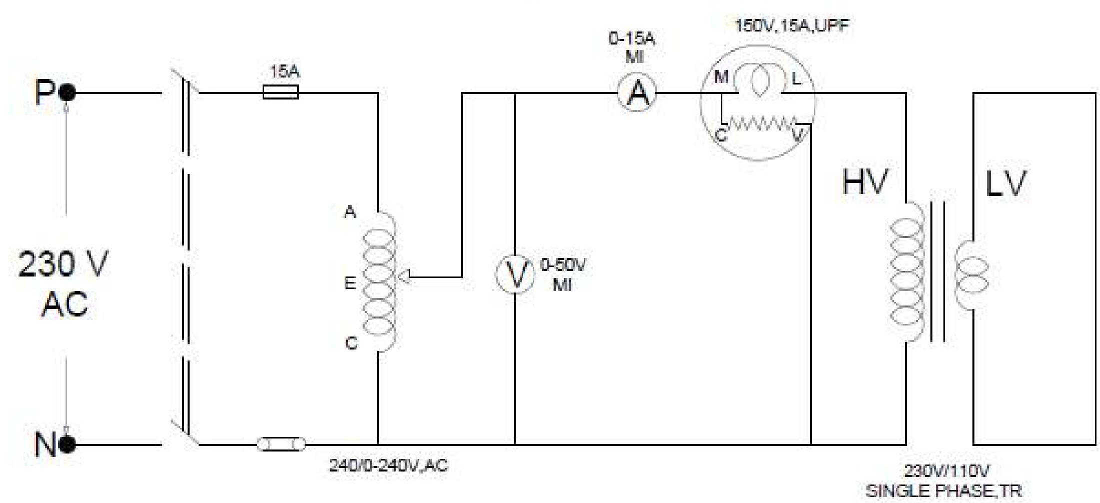
METERIALS REQUIRED:-

1. **Ammeter (0-15A) MI 1NO**
2. **Voltmeter (0-150v) MI 1NO**
3. **Wattmeter (300v,15A,lpf) 1NO**

THEORY:-

In the test with low voltage winding short circuited, allow voltage applied to the high voltage winding, the full load current are flow through both windings. The applied voltage is a small percentage of the normal voltage; the mutual flux is also small. Also the core losses are very small. The watt meter reading represents the full load Cu loss pf the transformer

SC TEST



PROCEDURE:-

1. Collect the materials for the given work.

2. Connection are done as shown in connection diagram.

3. Keep auto transformer at zero position.

4. Adjust the auto transformer up to rated current

5.Take voltmeter, ammeter and wattmeter reading.

V_{SC}	I_{SC}	W_{SC}

MODEL CALCULATION

V_{SC}=

I_{SC}=

W_{SC}=

Zsc=Vsc/Isc

$Rsc = Vsc/Isc^2$

Xsc=$\sqrt{(Zsc^2 - Rsc^2)}$

Ro1=Rsc

X01=Xsc

R01´=R01xk²

X01'=X01x k²

TO DRAW EFFICIENCY CURVE FOR A GIVEN P.F

Out put at X times F.L=X(rated KVA x 1000) cosØ

Core loss Wi= W0

Copper loss Wcs= X²Wsc

Efficiency=(Output /output+losses) x100.

Sl no	Load	Output(Watt)	Wi(watt)	Wcx(watt)	Input=Output+Wi+Wcx	%efficiency

TO DRAW REGULATION V/S PF CURVE

% regulation at F.L for a given P.F= $\frac{Irated(Rcos\emptyset \pm Xsin\emptyset}{V}$

Sl No	cosØ	sinØ	% Regulation

RESULT:-

Conducted SC test of transformer and Pre determined the efficiency and regulation .

Ploted the graphs

.LOAD TEST ON SINGLE PHASE TRANSFORMER

AIM:-

To conduct a no load test on given SINGLE PHASE TRANSFORMER and predetermine the regulation for deferent load.

MACHINE DETAILS:-

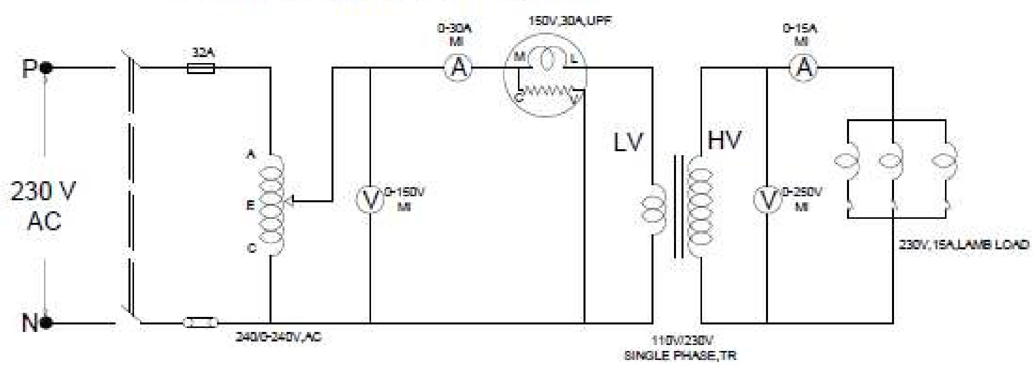
METERIALS REQUIRED:-

1. **Ammeter (0-15A) MI 1NO**
2. **Voltmeter (0-150v) MI 1NO**
3. **Wattmeter (300v,15A,upf) 1NO**
4. **Ammeter (0-5A) MI 1NO**
5. **Voltmeter (0-250v) MI 1NO**
6. **Wattmeter (300v,30A,upf) 1NO**

THEORY:-

When the secondary of transformer is loaded the terminal voltage drops.

LOAD TEST ON SINGLE PHASE TR



PROCEDURE:-

1. Close the DPST switch.
2. Adjust the autotransformer till the voltmeter reads rated voltage.
3. Note the no load readings and enter them as first set of readings in tabular column.
4. Close DPST switch.
5. Load the transformer gradually and take all meter readings each time till the secvondary current reaches rated value.

TABULATION

Sl No	I1 in Amps	V1 in volts	W in watts	I2 in Amps	V2 in volts	Input in watts	Output=V2xI2	%efficiency	% Regulation

CALCULATION

Output=V2xI2.

Input= W

%efficiency=$\frac{O/p}{i/p}$ x100.

Regulation= $\frac{oV2-V2}{oV2}$ x100.

RESULT:-

Load test on single phase transformer is conducted and efficiency and regulation curve are plotted.

LOAD TEST ON A DC SERIES MOTOR

AIM;

To conduct a load test on DC series motor and plot the following graph.

1) **Torque v/s armature current**
2) **Speed v/s armature current**
3) **Speed v/s torque**
4) **Efficiency v/s o/p**

MACHINE DETAILS:

APPARATUS REQUIRED:

1)	**Voltmeter**	**0-250V(MC)**	**1No**
2)	**Ammeter**	**0-15A(MC)**	**1 No**
3)	**Tachometer**		

THEORY:

In series motor the torque is directly proportional to armature current. Speed N is proportional to Ed/∅. In a series motor the field carries same current as the armature ie, ∅ ∝Ia. The series motor cannot be started without load.

Toque= (S1-S2)xgr

Output= $\frac{2\Pi NT}{60}$.

Input=VI.

%efficiency=$\frac{O/p}{i/p}$ **x100.**

TABULATION:

Sl No	Voltage(V)	Speed(RPM)	Spring balance			Torque = (S1-s2)rg	Output(W)	Input(W)	Efficiency(%)
			S 1	S 2	S1~s 2				

CALCULATION:

V= ………………..

Speed,N=………………………….

Spring balance, S1=……………………………

S2=……………………………………………..

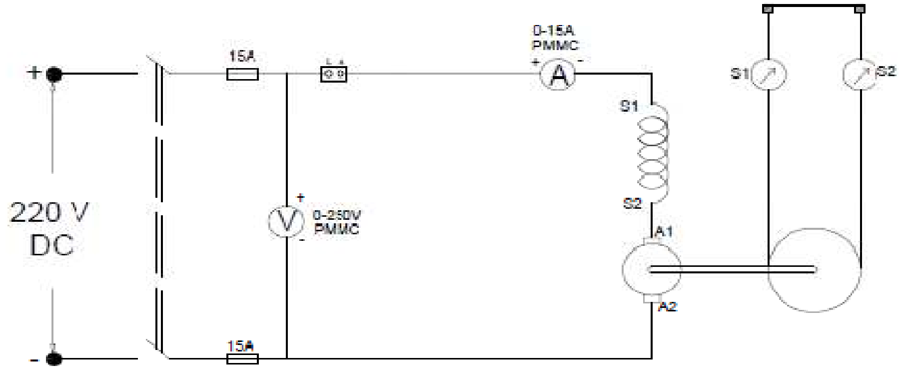
Torque,T= (s1~s2)rg,   r=Radius of break drum

g= 9.8

Output= $\frac{2\Pi NT}{60}$.

%efficiency=$\frac{O/p}{i/p}$ **x100.**

LOAD TEST ON DC SERIES MOTOR



PROCEDURE:

1) Connections are made as per diagram.
2) Apply a small load to the motor and start the motor.
3) Note the meter readings
4) Vary the spring balance at different load.
5) Note the corresponding readings.
6) Tabulate the reading and plot the graph.

RESULT:

The load test on series motor is conducted and plotted the graphs.

LOAD TEST ON A DC SHUNT MOTOR

AIM;

To conduct a load test on DCshunt motor and plot the following graph.

5) **Torque v/s armature current**
6) **Speed v/s armature current**
7) **Speed v/s torque**
8) **Efficiency v/s o/p**

MACHINE DETAILS:

APPARATUS REQUIRED:

1)	Voltmeter	0-250V(MC)	1No
2)	Ammeter	0-15A(MC)	1 No
3)	Ammeter	0-3A (MC)	1No
4)	Rheostat	500Ω,3A	1No
5)	Tachometer		

THEORY:

A load test is direct method,and this method is used only for small motors, because in the case of large motors it is difficult to dissipate large amount of heat generation

Toque= (S1-S2)xgr

Output= $\frac{2\Pi NT}{60}$.

Input=VI.

%efficiency=$\frac{O/p}{i/p}$ **x100.**

TABULATION:

Sl No	Voltage(V)	Speed (RPM)	Ish	Ia	IL=Ia+ Ish	Spring balance			Torque = (S1-s2)rg	Output(W)	Input(W)	Efficiency(%)
						S1	S2	S1~s2				

CALCULATION:

V= ……………….

Speed,N=………………………….

Spring balance, S1=…………………………….

S2=…………………………………………….

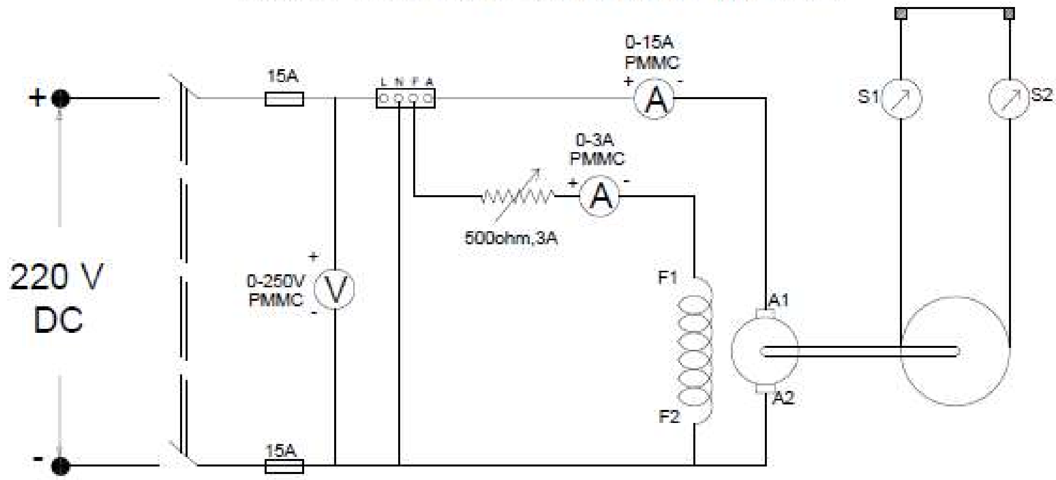
Torque,T= (s1~s2)rg, r=Radius of break drum

g= 9.8

Output= $\frac{2\Pi NT}{60}$.

%efficiency=$\frac{O/p}{i/p}$ **x100.**

LOAD TEST ON DC SHUNT MOTOR



PROCEDURE:

1) Connections are made as per diagram.

2) Rheostat kept in min. position

4) Start the motor using 4 point starter

5)Note the meter readings

6) Vary the spring balance at different load.

7) Note the corresponding readings.
8) Tabulate the reading and plot the graph.

RESULT:

The load test on shunt motor is conducted and plotted the graphs.