EXPERIMENT:- 01

AIM OF THE EXPERIMENT:-

Identification of different terminals of a DC machine by test lamp method and multi-meter method and to measure insulation resistance by megger.

TOOLS AND APPARATUS REQUIRED:-

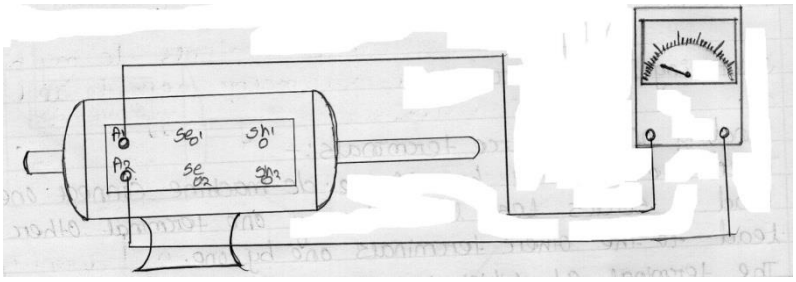
SL NO.	EQUIPMENT	SPECIFICATION	QUANTITY
01	A DC machine	DC shunt motor (1500rpm) 220V.3HP	1 no.
02	Digital Multimeter	0-20 mega Ω	1 no.
03	Series test lamp	100 watt	1 no.
04	Insulation tester	0-500 Volt	1 no.
05	Combination plier	15 C.M	1 no.
06	Screw driver	30 C.M.	1no.
07	Connecting Wire	$1.5m^2$	4 meter

THEORY:-

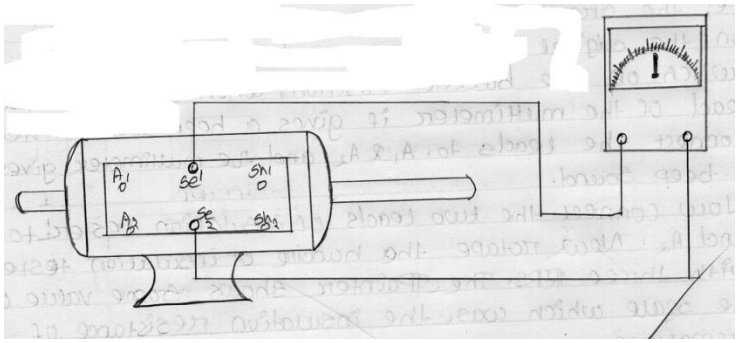
It is necessary to find out the proper terminals of field pole, armature etc. before connecting the generate with different loads. That can be founded by using multimeter and series lamp method. The insulation resistance armature, field winding should be found by using of insulation tester. If there is any types of defect like short circuit insulation damage or loss, burning can be find out by the above methods.

MULTIMETER METHOD:-

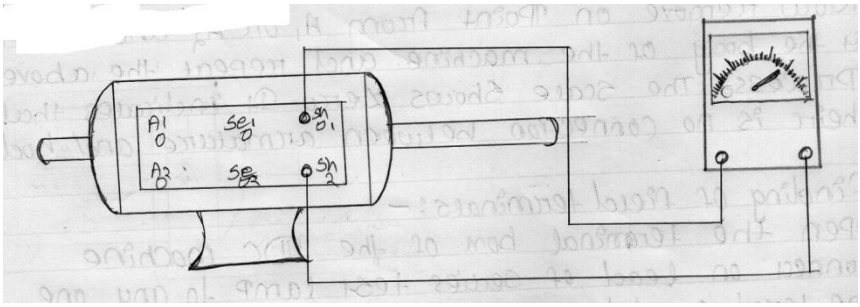
1. ARMATURE:-



2. SERIES FIELD:-



3. SHUNT FIELD:-

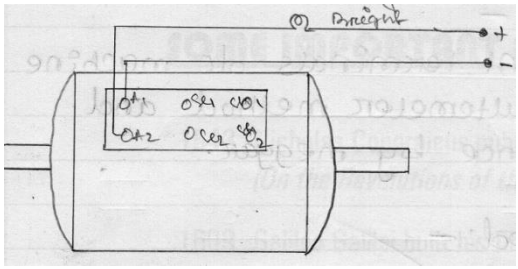


PROCEDURE:-

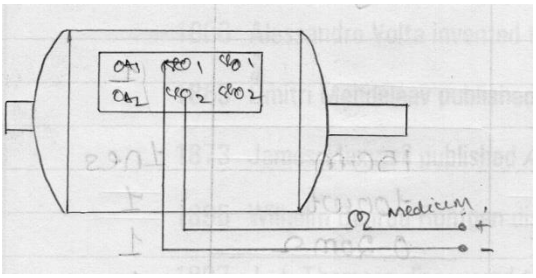
1. Finding of armature terminals:-
   a) Open the terminals box of the DC machine concept one load of series test lamp to any one terminal and other load to the other terminals one by one. The terminal at which the lamp glow brightly, that is the armature terminal A_1 and A_2 respectively.
   b) On the digital multimeter and put the selector switch on the buzzer position when connect the positive to load of the multimeter per sound their concept positive to the load to A_1 and A_2 and the multimeter gives a beep sound.
   c) Now connect positive to the load of insulator tester to $A_1$and A_2 rotate the handle of insulator taster with S.R.P.S. the pointer show some volve in the scale which was the insulator resistance of armature and the body.
2. Find the field terminals:-
   a) At first open the terminal box of the generator cannot be load to the series test lamp to the series test lamp to any one terminal and other load one by one.
   b) Two types of field are connected in generator one is series field winding and another is shunt field winding. The terminal of which lamp glow brightly this field is shunt field.
   c) Now connect the positive two loads of insulation tester to f_1 and f_2. Rotate 3 RPS. The pointer shows some value on the scale which was the insulation resistance of series field winding insulation resistance is low and it is shunt field winding insulation resistance is more as compare to series field winding.
   d) Remove one point form field winding and connect to the body of the machine, then repeat the above process, then the scale reading is zero. It indicate that no short circuit between field winding and body of the machine.

LAMP METHOD:-

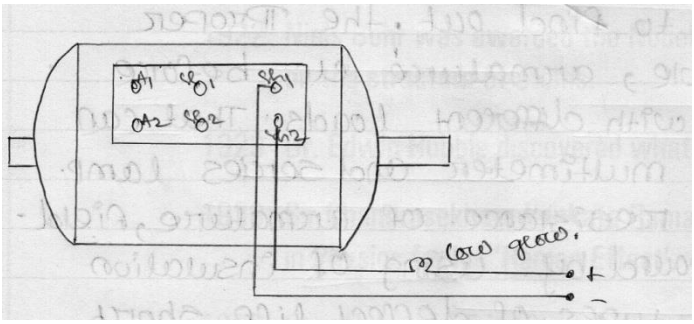
Case-1:: Armature-



Case-2:: Series Field-



Case-3:: Shunt Field-



TABULATION:-

METHODS	ARMATURE	SERIES WINDING	SHUNT WINDING
Multimeter method			
Megger method			
Lamp method			

CONCLUSION:-

From the above experiment we study about the identification of different terminals of a DC machine by lamp method, multimeter and megger method and measure insulation resistance.

EXPERIMENT NO.- 02

AIM OF THE EXPERIMENT:-

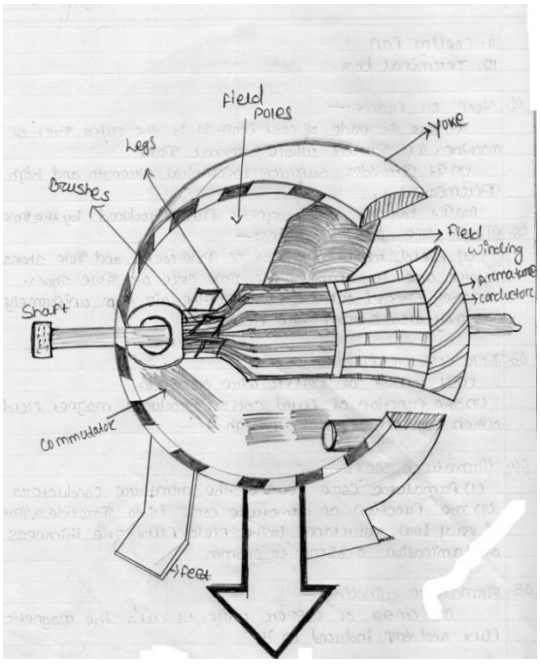
Dimensional and material study of various parts of a DC machine.

APPARATUS REQUIRED:-

SLNO.	ITEM	SPECIFICATION	QUANTITY
01	DC machine	DC shunt motor,200V,1HP	01
02	Combination Screw driver	250mm	01
03	Combination plier	15cm	01
04	Spanner set	Double ended	01

THEORY:-

1. Yoke or frame.
2. Pole core or pole shoes.
3. Field coil.
4. Armature core.
5. Armature winding
6. Commutator.
7. Brushes.
8. Bearing.
9. Eye bolt.
10. Shaft.
11. Cooling fan.
12. Terminal box.



[PARTS OF DC MACHINE]

01.YOKE OR FRAME:-

I. Yoke is made of cost Iron. It is the outer part of machine. It protect whole internal part.
II. It provides sufficient mechanical strength and high permeability.
III. It carries the magnetic flux produced by the poles.

02.POLE CORE OR POLE SHOES:-

I. Field magnet consist of pole cores and poles shoes. There are two function of pole core or shoes.
II. They spread out the flux in the air gap uniformly.
III. They also support the field coils.

03.POLE COIL OR FIELD COILS:-

I. It consists of copper wire or strip.
II. The function of field coil produced magnetic field when current passes through it.

04.ARMATURE CORE:-

I. Armature core houses the armatures conductors.
II. The function of armature core is to provide a path of very low reluctance to the field flux. The thickness of lamination 0.35mm to 0.5mm.

05.ARMATURE WINDING:-

It consist of copper wire. It cuts the magnetic flux and EMF induced in it.

06.COMMUTATOR:-

The function of commutator collect the current from armature conductor and it also convert AC to DC in external load. It is made up hard drawn copper.

07. BRUSHES:-

The function of brushes collect the current from commutator or slipping. It is made up carbon or graphite.

08.BEARING:-

The function of bearing is to reduced the function. Ball bearing are used which are lubricanted by oiler fed from oil reservation in the bearing bracket.

09.EYE BOLT:-

The function of eye bolt lifting the machine from one place to another place .

10.SHAFT:-

I. Armature and commutator is connect over the shaft.
II. It is made up mild steel.

11.COOLING FAN:-

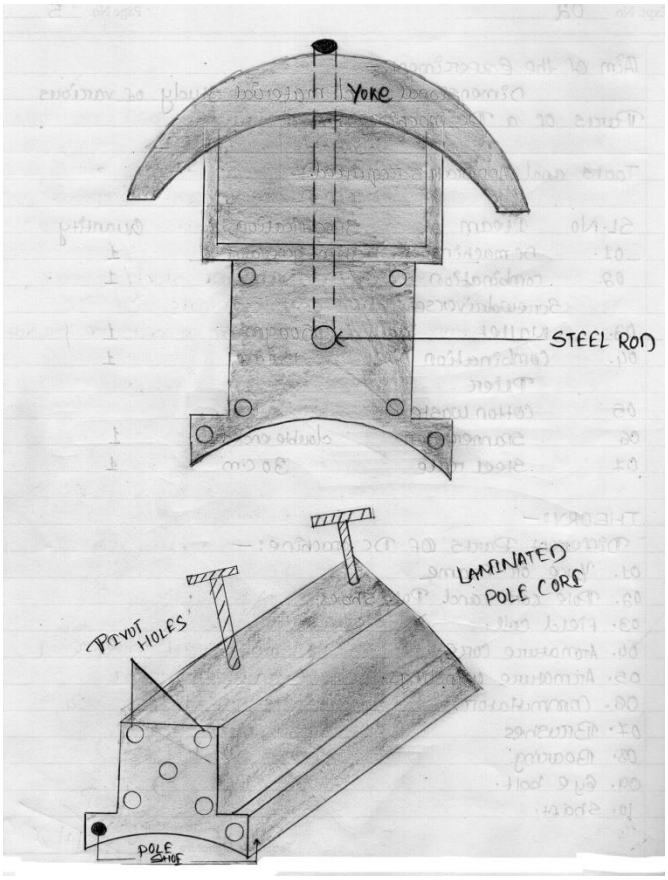
The function of cooling fan if cool all internal part of machine.

12.TERMINAL BOX:-

It is filled top of the machine.

PROCEDURE:-

I. At first enter to the workshop collect the required tools and raw materials.
II. Then overhead of a DC machine and measure the dimension of different part of the machine.



OBSERVATION:-

Circumference of yoke= 55c.m.

AD = 55c.m

D = 17.5c.m

External diameter of yoke = 17.5 c.m

Internal diameter of yoke = 14 c.m

Yoke length = 9.2 c.m

Pole length = 8.3 c.m

Pole height = 5.5 c.m

No. of pole = 02

No. of carbon brushes = 02

Circumference of armature = 2.6 c.m

Ad = 2.6 c.m

D = 8.17 c.m

Diameter of armature = 8.17 c.m

Length of armature = 5 c.m

Armature winding = A = P

No. of slot in armature = 16 (always even no.)

Length of commutator= 2.3 c.m

Commutator segments = 48
Commutator coils = 48
No. of conductor = 48*2 = 96
No. of conductor in each slot = 96/6 = 6
Circumstances of commutator = 180c.m
Diameter of commutator = 5.72c.m
Durance of air gap = D-d/2
= (8.3-8.17)/2 = 0.065c.m

CONCLUSION:-

In the above experiment we will be study and measure the dimension of the different part of the DC machine.

EXPERIMENT NO. :- 03

AIM OF THE EXPERIMENT:-

To study of three point starter, connect and run a DC shunt motor and measure the no. current.

APPARATUS REQUIRES:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	3 point starter	220v, 12amp	01
02	Shunt motor	250v,3HP,1550 rpm	01
03	Multimeter	0.20MΩ	01
04	Series test lamp	200watt	01
05	Screw driver set		01
06	Combination plier	15c.m	01
07	Connecting wires	$1.5mm^2$	As per required
08	tachometer		01

THEORY:-

DC 3- point starter is used to start DC shunt motor safely. As shunt motor armature has little resistance it will take high current. Thus it may damage. So by using 3-point starter, we can run the motor safely.

A 3-point starter consists of the following parts.

I. Resistance.
II. Handle.
III. Studs.
IV. No volt coil.
V. Over load coil.
VI. The three points are L,A and F.

When a motor is connected with supply, the current to the armature gives through the starting resistances and the field winding is connected to the mains directly through the NVC. When motor contains speed same back EMF is induced in the armature. The starting resistance will gradually cut by the handle and thus the starting current is reduced is lower value.

NO- VOLT COIL:-

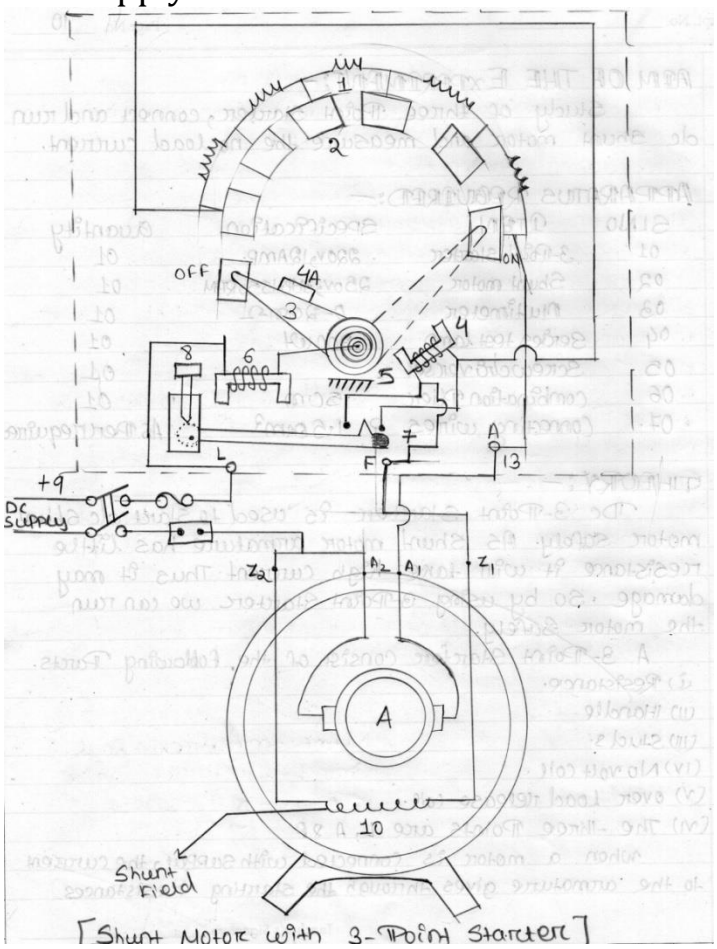
This is a safely device connected to the starter. It consist of a thin wire of many turns and is connected in series with the field winding of the motor. When current flows it magnetized. Its function is to attract the metallic handle due to failure of supply and the handle goes to 'off' position by tension spring. By this way supply will disconnect from motor.

OLRC:-

Its function is to demagnetize the NVC in the case of fault or overload of the machine. It consists of few terms of thick wires connected in series with armature due to some fault or overload. Now the coil attract the tripling plunger which short circuit the terminal of NVC, so on the NVC will demagnetized and release the handle. Thus motor stops.

WORKING PROCEDURE:-

I. Draw the circuit diagram and check it.
II. Indentify the terminals of motor and starter by series test.
III. Connect the A_1 of motor to A point of starter.
IV. Connect the F_1 of motor to F point of starter.
V. Connect A_2*F_2 with negative terminal to supply.
VI. 'ON' the supply and gradually move the handle motor starters running.
VII. Continue the process of motor attain full speed.
VIII. Check the RPM by tachometer.
IX. Check current and voltage.
X. Disconnect the supply.



[Shunt Motor with 3-Point Starter]

TABULATION:-

SL NO.	STARTING CURRENT IN AMP.	RUNNING CURRENT IN AMP.	RPM
01			
02			
03			

CONCLUSION:-

From the above experiment we study above 3- point starter connect and run the DC shunt motor.

EXPERIMENT:- 04

AIM OF THE EXPERIMENT:-

Study of 4- point starter, connect and run a DC compound motor and measure and measure no load current.

TOOLS, EQUIPMENT REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	4- point starter		01 nos.
02	Compound motor	3HP,1500RPM,230V	01nos.
03	Multimeter	Digital	01nos.
04	Connecting wires	$2.5mm^2$	As per required
05	Series test lamp	200watt	01nos.
06	Screw driver set		01nos.
07	Combination plier	1.5c.m	01nos.

THEORY:-

DC 4- point starter is used to start DC compound motor supply. As compound motor armature has little resistance it will take high current thus it damage. So by using 4- point starter we can run the motor safely.

4- point starter consists of following parts:-

- Resistance .
- Protective resistor.
- Handle.
- Studs.
- No- volt coil.
- Over load release coil.
- 4- point are 4,L_2A and F.

When a motor is connected with supply, the current to the armature gives through the current to the armature gives through the starting resistance and field winding is connected to the mains directly through the NVC.

When motor attains speed some back EMF is induced in the armature the starting resistance will be gradually cut by the handle and thus the starting current is reduced to a lower value.

The four point starter differs from the 3-point starter. In the holding coils is not connected in series with the shunt field circuit is not connected across. The supply in series with a resistor the resistor limits. The current in the holding coils serves as a non- voltage release rather than as a no filed release, if the line voltage drops below.

The desired value, the magnetic attraction of the holding coil is decreased and then the spring pull the starter handle back to the 'off' position.

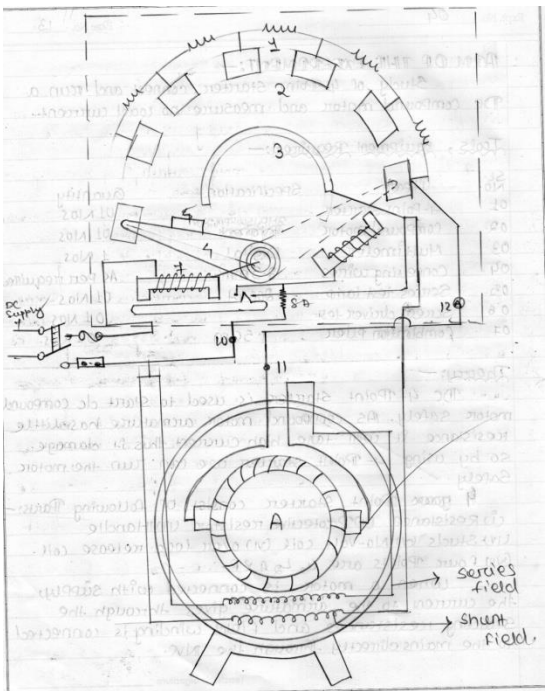
WORKING PROCEDURE:-

- Draw the circuit diagram and check it.
- Identify the terminal of motor and starter by series test.
- Connect the B_1 of motor A point of starter.
- Connect the E_1 of motor of F point starter.
- Connect E_1 and A_2 with negative terminal to supply.

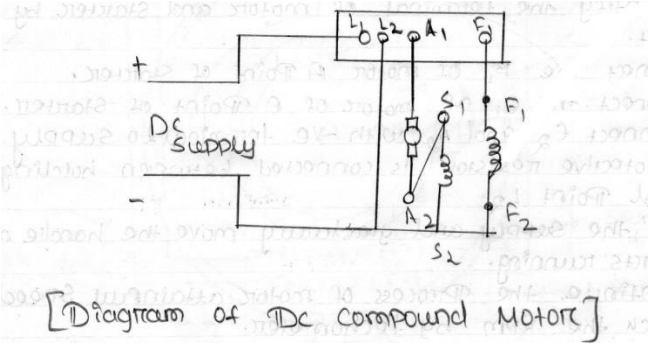
- ❖ Protective resistor is connected between holding, coil and point L_2.
- ❖ 'ON' the supply and gradually move the handle motor starts running.
- ❖ Continue the process of motor attain full speed.
- ❖ Check the rpm by tachometer.
- ❖ Check the current and voltage.
- ❖ Disconnect the supply.

COMPOUND MOTOR WITH 4- POINT STARTER:-

- Starting resistance.
- Brass.
- Brass strip.
- Starting handle.
- Iron bar.
- No volt release coil.
- Over load release coil.
- Tripling revere with contact point.
- Positive terminal.
- Negative terminal.
- Shunt field.
- Armature terminal.
- DPIL main switch.
- DC motor.



[4- POINT STARTER]



[Diagram of DC compound Motor]

TABULATION:-

SL NO.	STARTING CURRENT IN AMP.	RUNNING CURRENT IN AMP.	RPM
01			
02			
03			

CONCLUSION:-

From the above experiment we study above the four point starter connect and run DC compound motor.

EXPERIMENT NO.:- 05

AIM OF THE EXPERIMENT:-

To control the speed of a DC shunt motor by field flux control method and armature voltage control method.

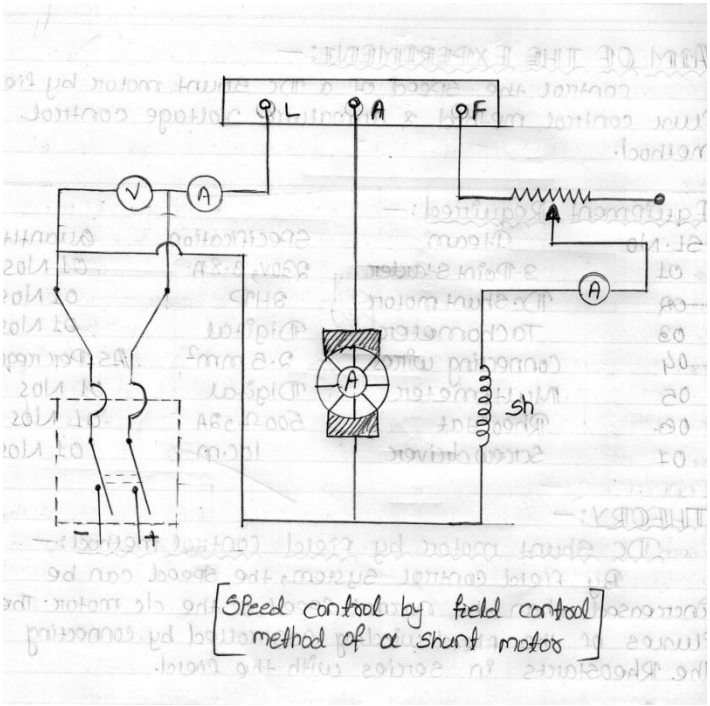
EQUIPMENT REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	3- point starter	230v, 6.8A	01nos
02	DC shunt motor	2Hp	01nos
03	Tachometer	Digital	01nos
04	Connecting wires	$2.5mm^2$	As per required
05	Multimeter	Digital	01nos
06	Rheostat	500Ω,2A	01nos
07	Screw driver	10c.m	01nos

THEROY:-

DC SHUNT MOTOR BY FIELD CONTROL METHOD:-

By field control system, the speed can be increased than the normal speed of the DC motor. The fluxes of the field winding controlled by connecting the rheostats in series with the field.



PROCEDURE:-

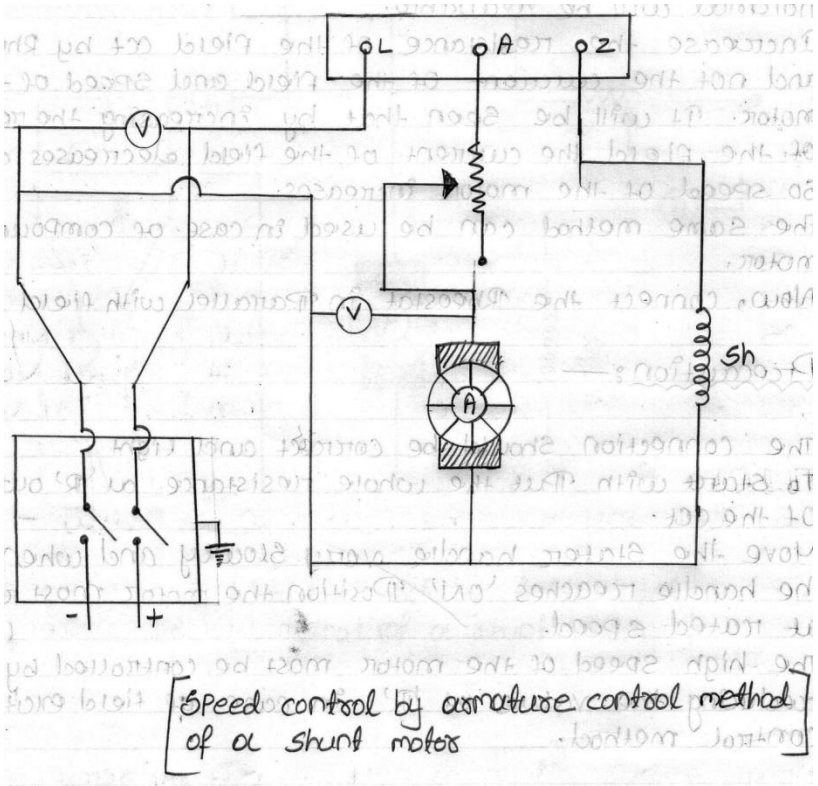
→ Draw the circuit diagram and check it by series test.

→ There are two methods of regulating the speed of the motors.

→ Now connect the rheostat of 500Ω in series with the field also connect the armature in series with the field.
→ Start the motor, note the speed of the motor and current of the field of the motor higher speed than normal will be available.
→ Increase the resistance of the field circuit by rheostat and not the current of the field and speed of the motor. It will be seen that by increasing the resistance of the field the current of the field decreases and so speed of the motor increases.
→ The same method can be used in case of compound motor.
→ Now, connect the rheostat in parallel with field.

PRECATION:-

→ The connecting should be correct and tight.
→ To start with put the whole resistance at 'R' out of the circuit.
→ Move the starter handle very slowly and when the handle reaches 'ON' position the motor most run at rated speed.
→ The high speed of the motor most be controlled by reducing the value of 'R' in case of field excitation controlled method.



Speed control by armature control method of a shunt motor

DC SHUNT MOTOR BY ARMATURE VOLTAGE CONTROL METHOD:-

By armature control method the speed can be increased than the normal speed of the normal speed of the DC motor. The fluxes of the armature winding controlled by the connecting of rheostat in series with the armature.

PROCEDURE:-

1. Now connect the rheostat of 500Ω in series with the armature in series with field.
2. Make the connections of the shunt motor armature with rheostat of low resistance and high current capacity in series. Also connect the armature n series with the armature.
3. Increase the resistance of the armature circuit. Note the current of armature and speed of the motor. It may be seen that by increasing the resistance of the armature circuit, the current in the armature is reduced and speed is loss.
4. This type of condition can also be done in this case of compound motor.
5. In series motor connect the dive for rheostat in parallel with the armature.
6. Now connect the resistance in parallel with the armature and regulate the speed of motor and the armature current and speed. It is seen that the speed is regulated less than the normal speed of the series motor by connecting the diverter in parallel with the armature.

TABULATION:-

SL NO.	**FIELD CONTROL METHOD**		**ARMATURE VOLTAGE METHOD**	
	FIELD CURRENT	**SPEED**	**ARMATURE FIELD**	**SPEED**
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				

CONCLUSION:-

From the above experiment we study that control the speed of DC shunt motor by armature voltage control method and field control method.

EXPERIMENT:- 06

AIM OF THE EXPERIMENT:-

To determine the armature current vs. speed characteristics of a DC motor.

TOOLS AND EQUIPMENT REQUIRED:-

SLNO.	ITEM	SPECIFICATION	QUANTITY
01	DC shunt motor	05Hp	01set
02	Digital multi meter	500v, 10A	01nos
03	Digital tachometer		01nos
04	Line tester	0-500v	01nos
05	Screw driver set		01set
06	Combination pliers	20cm	01nos
07	Test lamp with holder	200watt	01nos
08	Connecting wires	$2.5mm^2$	05MTR
09	Cotton waste		20GM

THEORY:-

The DC motor have many characteristics like

→ T/I a characteristics

→ N/T characteristics

→ I a / N characteristics

Here we are discussing about armature current vs. speed characteristics (Ia/N) of a DC shunt motor. We know that the speed of a DC motor(N) is directly proportional to Eb/Φ that is $N \alpha E b/ \Phi$

Where E b = v- Ia Ra

Eb = back emf.

V = voltage at field winding

Ia = armature current

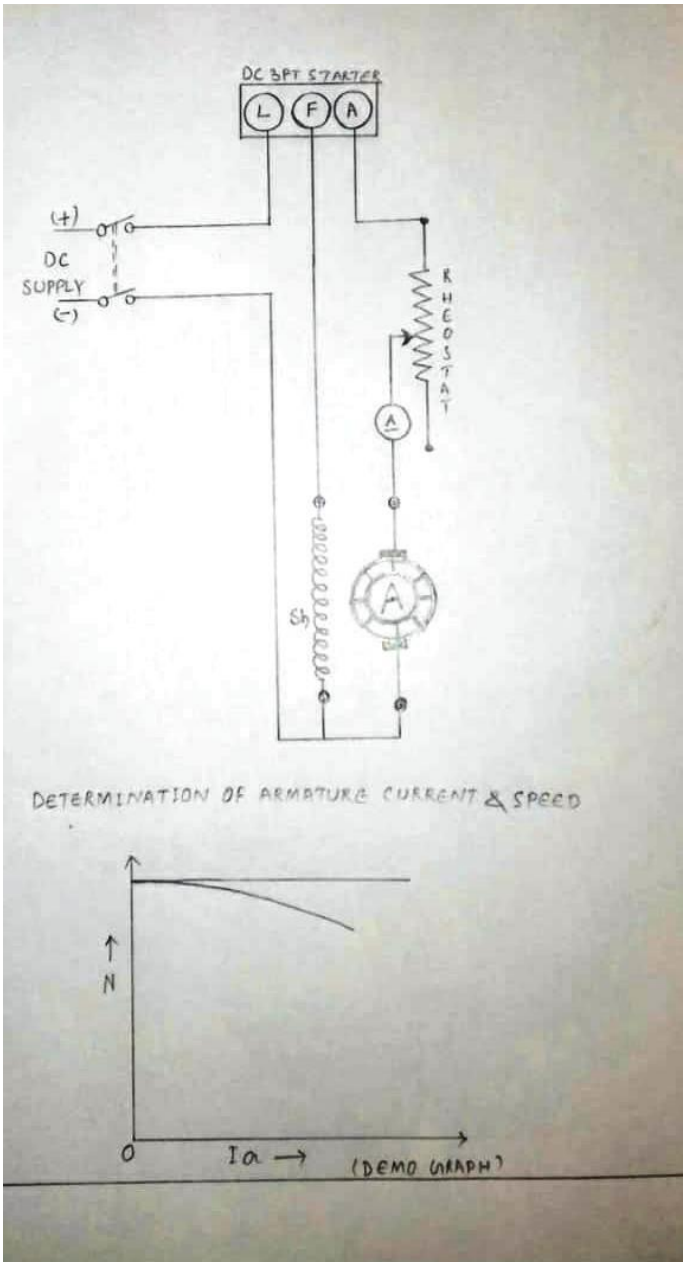
Ra = armature resistance

The Ra is very small, so the IaRa drop does not change very much with respect to load on motor because the Eb is approximately constant for shunt motor (as shunt motor runs at constant speed).

So the shunt motor is used for constant load, such as water pump, saw mills, blowers, lathes, wood working machine etc.

But it is important that both Eb and Φ decrease with the load. Eb decreases a little more than Φ and hence the speed 'N' of the motor decrease a little with rise in load. There is no danger of attending the motor a high speed at little load because the speed does not vary with load.

Thus by controlling the armature current, one curve will obtain showing the relation between Ia & N.



WORKING PROCEDURE:-

→ First we collect all tools, equipments.
→ Switch 'ON' the ACDB and then the rectifier unit.
→ Check the voltage and gone to DC shunt motor.
→ First we clean the motor and connect all the equipment as per circuit diagram.
→ 'ON' the rotary switch and check the DC voltage.
→ Now ON the 3- point starter and we wait till attends the full speed.
→ Now we set the rheostat by measure the speed and set it to 1500RPM.
→ The actual experiment starts now.
→ Gradually move the handle of the rheostat to a certain position.
→ The speed decreases to a certain limit.
→ Measure the speed by using tachometer and note down the corresponding current through multi meter.

→ Repeat the same process up to 10 times.

→ The main important process is that the rheostat will connect in series with armature as we control the Ia.

→ Gather all the reading and plot the graps which shows the curve of Ia vs. N.

TABULATION:-

NO. OF OBS	ARMATURE CURRENT (Ia) IN AMP.	SPEED IN RPM	REMARK
01			
02			
03			
04			
05			
06			
07			
08			
09			

CONCLUSION:-

From the above experiment, we will able to control the DC motor with respect to armature current. Observe the speed corresponding to that and read out the characteristics by plot the graph.

EXPERIMENT NO. :- 07

AIM OF THE EXPERIMENT:-

To determine the efficiency of a DC machine by brake test method.

TOOLS AND EQUIPMENTS REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	DC motor with starter	05Hp, 4Kw	01 set
02	Ammeter (Mc/Mi)	0-25 Amp	01 nos.
03	Voltmeter (Mc/Mi)	0-300V	01 nos.
04	Tachometer	Multi range	01 nos.
05	Spring balance	0-50 kg	02 set
06	Break testing belt/ rope		05Mtr
07	Connecting wires	2.5 mm^2	06Mtr
08	Screw driver set		01set
09	Combination plier	20 cm	01nos.
10	Wrench set		01set
11	Powder/ wet resin		100Gm
12	Cotton waste		200Gm

THEORY:-

The break test method is with method DC motor only. By this test we find out the BHP and efficiency of the respective motor (series, shunt or compound).

The efficiency of a motor is simply the ratio between mechanical output by the motor and the electrical input to motor. The output is always less than the input.

So output= input-losses.

→ Efficiency = output/input= (input-losses)/input.

→ % efficiency = (output/input)* 100%.

In case of motor, the efficiency(η) may be classified as follows.

→ Mechanical efficiency(ηn)

→ Electrical efficiency (ηe)

→ Commercial efficiency(ηc)

ηm = V/ commercial efficiency =

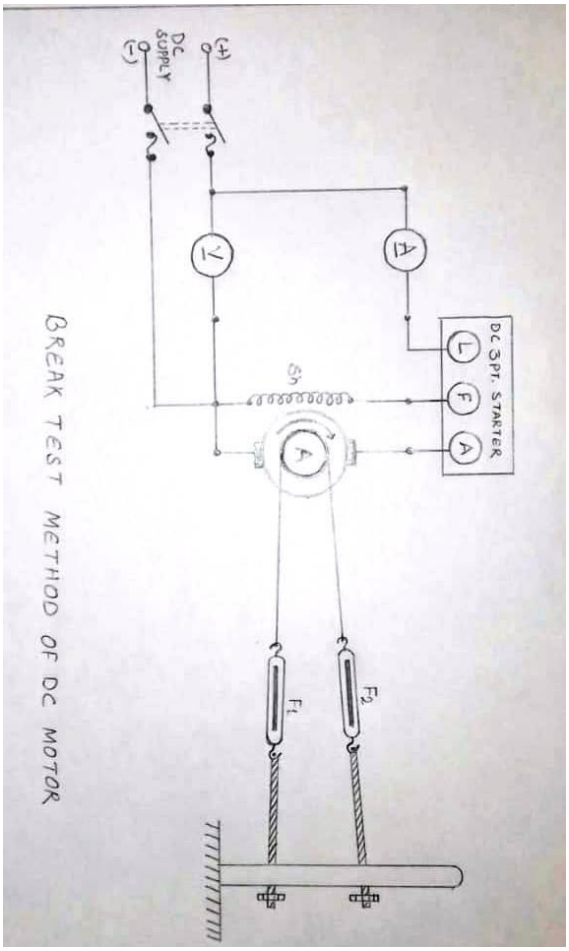
motor output/ mechanical power developed = (bhp*746)/ (Eb*Ia)

ηe = commercial efficiency/ mechanical efficiency

= mechanical power developed/ electrical power input = (Eb*Ia)/(V_L*I_L)

ηc = V/ ηm = motor BHP/ electrical power input = (BHP* 746)/ (V_L*I_L)

- Iron and friction loss = ηc – V= (Eb*Ia)- BHP
- Copper loss= ηm-ηc = (V_L*I_L) – (Eb * Ia)



WORKING PROCEDURE:-

- In this experiment, we start the motor at no load and gradually increase the load till the motor stop or the break testing rope/belt will broke, whichever is earlier. This last point will show the maximum efficiency of motor.
- So first we collect all the tools and equipments and gone to motor.
- ON the ACDB and rectifier unit.
- Connect as per circuit diagram.
- Start the motor by moving the handle of starter and check the V, I and N. (This will done at no load and the motor will stop for observation)
- Now increase the tension of the belt/ rope by tightening the wing nuts of spring balance to a particular value.
- Start the motor carefully and record the voltmeter, ammeter, RPM and the reading of spring balance (F1 and F2) and stop the motor.
- Tight the wing nut again to a certain value and start the motor carefully.
- Record all corresponding values.
- Repeat the process for complete observation till the motor stops itself or the rope will break.
- The point of which the rope/ belt null break indicate the maximum efficiency.
- Measure the dia of pully.
- Draw a graph between input and η.

TABULATION:-

NO. OF OBS	F1 IN Kg	F2 IN Kg	DIA OF PULLY	SPEED IN RPM	OUTPUT= {[TTd(F1-F2)*n]/WATTMETR}* 746	V IN VOLT	I IN AMP	INPUT IN WATT	η IN %

CONCLUSION:-

From the above experiment, we will find the efficiency of DC motor by break test method and the input/output through various calculations. Analyze the graph of efficiency.

EXPERIMENT NO.:- 08

AIM OF THE EXPERIMNENT:-

To identification of terminals determination of voltage transformation ratio of a single phase transformer.

TOOLS AND EQUIPMENTS REQUIRED:-

SLNO.	ITEM	SPECIFICATION	QUANTITY
01	1Φ TRANSFORMER(VARIABLE)	125v/250v 2Kva	01nos.
02	Digital voltmeter	0-300v	02nos.
03	Digital ammeter	0-10 A	02nos.
04	Digital multi meter		01nos.
05	Test lamp with holder	2000W	01nos.
06	Screw driver		01set
07	Line tester	0-500V	01nos.
08	Combination plier	20cm	01nos.
09	Connecting wires	$1.5mm^2$	08Mtr
10	Insulation tape	15mm	01 role

THEORY:-

Transformer is a static device which transfer the electrical power from one circuit/ winding to another circuit/ winding without changing the frequency. Generally it increase or decrease the voltage technically known as step up or step down according to the use of transformer. In a single phase transformer, there is two winding that is primary and secondary. The side which connect to the supply which gives the supply is known as primary and the side which gives the supply is known as secondary.

Simply is the input voltage is greater than output voltage, the transformer is a step up transformer and is the output voltage is less than input voltage, it is a step down transformer. The corresponding voltage and current are also known as primary and secondary voltage and current. That is Vp and Vc, Ip and Is.

The transformer transfer the voltage from primary to secondary in a proper ratio which is known as transformation ratio. The transformation of voltage depends upon the no. of turns in the winding.

If Np is the no. of turns in the primary winding, the RMS value of the induced EMF at primary is given by Ep= 4.44Φm £ Ns volt ----------(1)

If N, is the no. of turns in the secondary winding, the EMF induced is given by Es= 4.44Φm£ Ns volt----------(2)

Φ= flux in wb.

£ = frequency (constant)

The primary and secondary frequency is same as same flux is linked with both the winding.

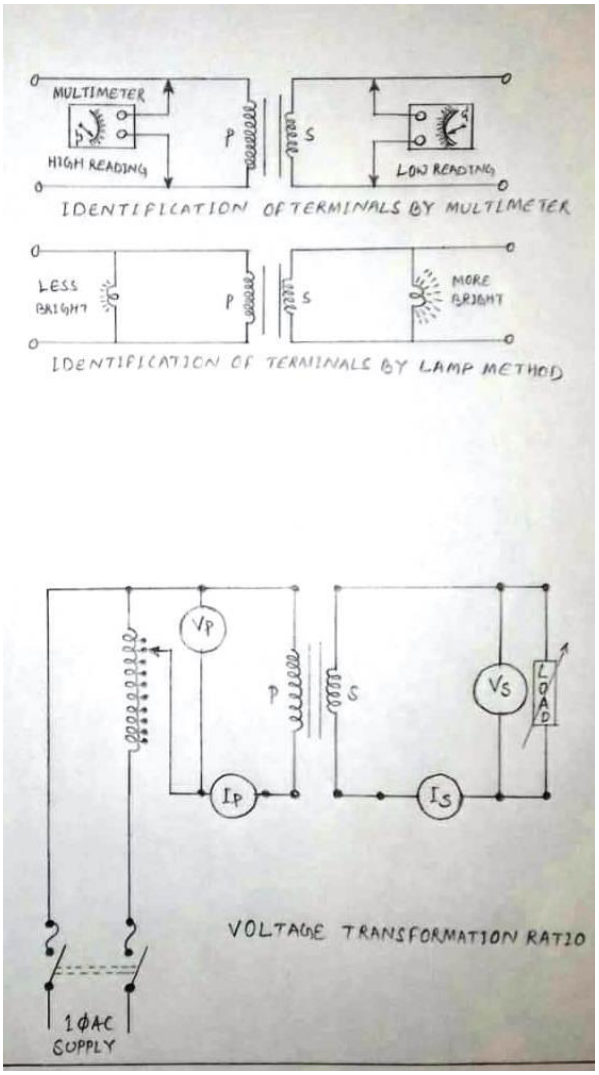
Now by dividing both the equation(2) and (1)

Es/Ep= 4.44Φm £Ns/ 4.44 Φm £Np

⇨ Es/Ep = Vs/Vp = Ns/ Np= K(transformation ratio)

⇨ Es/Ep= Vs/Vp (here E= no load voltage and V = full load voltage)

So we find that Es/Ep and Vs/Vp are the voltage transformation ratio at no load and full load respectively.



WORKING PROCEDURE:-

- → First we collect all the loads and equipments and gone to the transformer.
- → We have to conduct the experiment with no load and full load.
- → First we open the front panel of the transformer where all the terminals one assembled and connected.
- → We open all the connection and stat experiment by connecting the multi meter.
- → First we set the selector switch of the multi meter to Ω side. Connect the two nodes of the meter to any of the two terminals of transformer randomly.
- → In lamp testing method we have to connect and test the terminals in this way also.
- → If it will give some reading means that two points are inter connected. If multi meter not showing ant reading, connect any other two terminals where it may give reading. Note down the reading.
- → After all observation by multi meter, the two terminals which give high value of resistance means it will be the H.T side. (No. of turns is more)
- → As well as the low resistance points is indicate the LT side.(No. of turns is less)

→ Now by using series lamp we find that the H.T side will give dim light and L.T side give bright light.
→ Now we connect the transformer with AC supply and start the experiment for voltage transformation ratio.
→ Connect voltmeter and ammeter to both primary and secondary side.
→ Switch 'ON' the supply and set the primary voltage to a random value by connecting varial.
→ The corresponding voltmeter and ammeter will show the values. Note down all the value for tabulation and observation.
→ Repeat the process for few times and check the output by multi meter and test lamp load.

OBSERVATION TABLE:-

NO. OBS	PRIMARY CURRENT	PRIMARY VOLTAGE	SECONADRY CURRENT	SECONDARY VOLTAGE	VOLTAGE TRANSFORMATION RATIO (K)
					Vs/Vp=
					Vs/Vp=
					Vs/Vp=
					Vs/Vp=
					Vs/Vp=

CONCLUSION:-

From the above experiment, we will find the terminals (unknown) of transformer by test lamp method and multi meter. Studding the transformer and find the voltage transformation ratio of that transformer.

EXPERIMENT NO.:- 09

AIM OF THE EXPERIMENT:-

To perform OC test and SC test of a single phase transformer.

TOOLS AND EQUIPMENTS REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	Adjustable 1Φ transformer	125/250v, 2Kva	01 set
02	Digital ammeter	1Φ 20 Amp	02 nos.
03	Digital voltmeter	1Φ 300V	02nos.
04	Digital wattmeter	1Φ 2Kw	01nos.
05	Test lamp with holder	200w	01nos.
06	Connecting wires	$2mm^2$	06Mtr
07	Screw driver set		01set
08	Combination plier	20cm	01nos.
09	Insulation tape	15mm	01Role
10	Cotton waste		20Gm

THEORY:-

(OPEN CIRCUIT TEST)

→ We know that the transformer is a static device, so there is no rotational losses. But inside the core of transformer two types of loss occurs. That is eddy current loss and hysteresis loss. To determine these OC test is done.

→ As the iron loss is depends upon voltage and frequency of the supply. This test is performed at normal supply that is normal voltage and frequency. That supply is given to the primary winding by connecting wattmeter, voltmeter and ammeter. The secondary side is kept open. The no load current is very small and the copper loss may be neglected. Then the connected watt meter will show the reading of iron loss which is main aim of OC test.

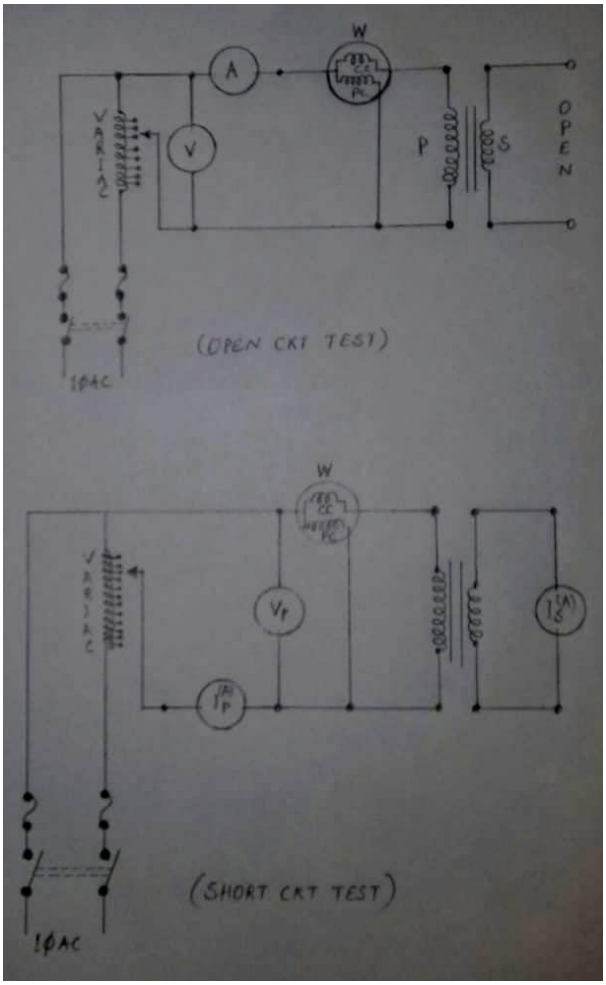
(SHORT CIRCUIT TEST)

→ This test is conducted to find out the copper loss of the transformer. The copper loss directly proportional to the square of the current in the transformer winding.

→ In this test, the primary winding (casually HV side), is supplied with low voltage at normal frequency from a varial.

→ The secondary winding is short circuited directly through an ammeter of high range. Applied voltage is gradually increase till full load current is flow through primary winding. As applied voltage is small % of normal working voltage, the core loss will be very small. Iron loss will be neglected in this case.

→ As the secondary is short circuited, the current flow through it is maximum, said to be full load current. Thus the wattmeter will show the copper loss of the transformer at full load.



WORKING PROCEDURE:-

(OC TEST)

→ First collect all the tools and raw materials and gone to transformer set.
→ Open the terminals box and find HT and LT side by using test lamp.
→ Connect the voltmeter, ammeter and wattmeter in primary winding.
→ The secondary is kept open and no connection will be done.
→ Now switch 'ON' the transformer and give the maximum voltage to transformer.
→ The voltmeter, ammeter and the wattmeter will shows the value.
→ Note down the reading and repeat the process with variation of voltage.
→ After collect data, make tabulation.
→ Wattmeter will shows the iron loss.

TABULATION FOR OC TEST:-

NO. OF OBS	AMMETER(Ip) READING (A)	VOLTMETER READING(Vp)	WATTMETER READING(W)	IRON LOSS(W)

(SC TEST)

→ Draw the connection diagram.
→ Find out the LT and HT side of T/F.
→ Before experiment, find out the calculation of full load current from the ratings of the transformer by using the formula as it is compulsory to know the full load I. For single phase Ip= (KVA*100)/ VP and Is= (KVA* 100) / Vs.
→ Now make connection and apply a small voltage to primary.
→ Take reading and make tabulation.
→ Wattmeter will show the copper loss.

TABULATION FOR SC TEST:-

NO. OF OBS	PRIMARY VOLTAGE(Vp)	PRIMARY CURRENT(Ip)	SECONDARY CURRENT(Is)	WATTMETER READING(W)	COPPER LOSS (W)

CONCLUSION:-

From the above experiment, we will able to find out LT,HT, side of transformer. Per for OC and SC test. Find the iron loss and copper loss in both theoretically and practically.

EXPERIMENT NO:- 10

AIM OF THE EXPERIMENT:-

Determine the voltage regulation of a single phase transformer at a different loads.

TOOLS AND EQUIPMENTS REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	1Φ transformer	125/250v 2Kva	01 set
02	Digital voltmeter	1Φ, 0-300v	02nos.
03	Digital ammeter	1Φ, 0-30A	02nos.
04	Digital multi meter		01nos.
05	Connecting wires	$2.5mm^2$	06Mtr
06	Lamp load (resistive)	2000w	01 set
07	Screwdriver set		01 set
08	Insulated combination plier	20cm	01 nos.

THEORY:-

The regulation of the transformer is the difference in voltage in secondary side from no load to full load. It is generally expressed as a percentage of the secondary no load voltage. The regulation of transformer based on voltage is known as voltage regulation.

VR = (No load secondary voltage - full load secondary voltage)/ No load secondary voltage

VR = (Es-Vs) / Es

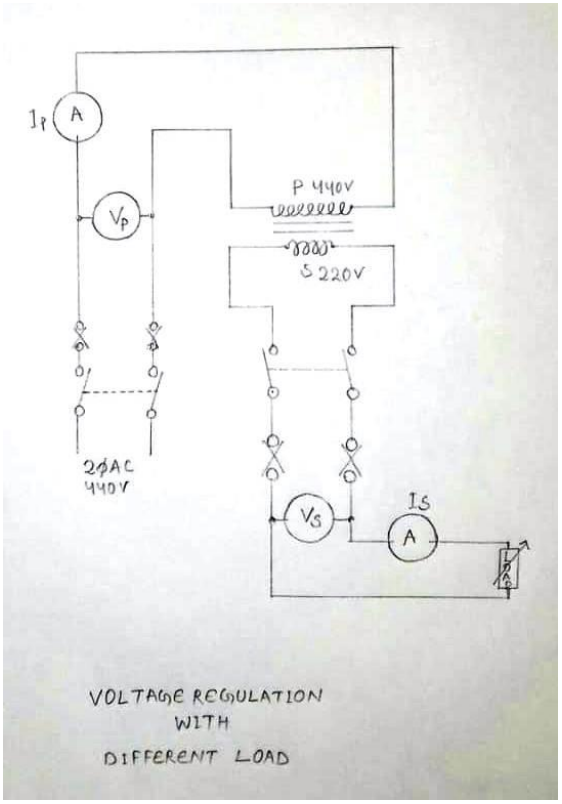
When it is expressed in percentage

regulation% = (Es-Vs)/Es* 100

{Es= No load secondary voltage & Vs= Full load secondary voltage}

WORKING PROCEDURE:-

→ First we draw the circuit diagram.
→ Collect all the tools and equipment.
→ Gone to single phase transformer set.
→ Find out the L.T and H.T side of the transformer by series test.
→ Connect the measuring instrument in both primary and secondary side according to circuit diagram.
→ Connect the primary side of T/F with (2Φ 440 v) supply.
→ Connect the secondary side with resistive load (lamp load).
→ Put the switch 'ON' and take reading of voltmeter & ammeter of both side.
→ Repeat the experiment with no load and full load.
→ Take reading and calculate the regulation.



OBSERVATION TABLE:-

NO. OF OBS	LOAD COND.	Ip IN AMP	Vp IN VOLT	Is IN AMP	Es&Vs IN VOLT	PF PF Is 1 AS LOAD As ONLY(R)	% REGULATION {(Es-Vs)/ Es }*100
	NL				(Es)		
	NL				(Es)		
	NL				(Es)		
	FL				(Vs)		

CONCLUSION:-

From the above experiment, we were able to find out the voltage regulation percentage by using transformer at no loads full load. Also gain a knowledge about running the transformer with 2Φ AC.

EXPERIMENT:- 11

AIM OF THE EXPERIMENT:-

Polarity test of single phase transformer and parallel operation of two single phase transformer.

TOOLS AND EQUPIMENTS REQUIRED:-

SL NO.	ITEM	SPECIFICATION	QUANTITY
01	1Φ transformer	125/250v,2Kva	02 set
02	Digital voltmeter	1Φ, 0-300v	04nos.
03	Digital ammeter	1Φ,0-20Amp	02nos.
04	Connecting wires	$2.5mm^2$	08Mtr
05	Dpic switch	30A, 250V	02 set
06	Sp/one way switch	06A, 250V	02set
07	Screw sriver set		01set
08	Combination plier	20cm	01nos.

THEORY:-

(POLARITY TEST)

→ The polarity test is done on transformer before connecting two transformer in parallel.

→ The main aim is to identify the positive and negative terminals of the two transformer.

→ Without same polarity, parallel operation is not possible.

→ This is to ensure that we have connected the same polarity, not the opposite once. If we accidently connect the opposite polarity, it will result a short circuit and eventually damage the machine.

→ The polarity is of two types, that is

#Additive polarity

#Subtractive polarity

Additive polarity:-

In this polarity the voltage (Vc) is the sum of both high & low voltage or primary and secondary voltage.

Vc = Vp+Vs

Subtractive polarity:-

In this polarity the voltage (Vs) is the difference between high and low voltage.

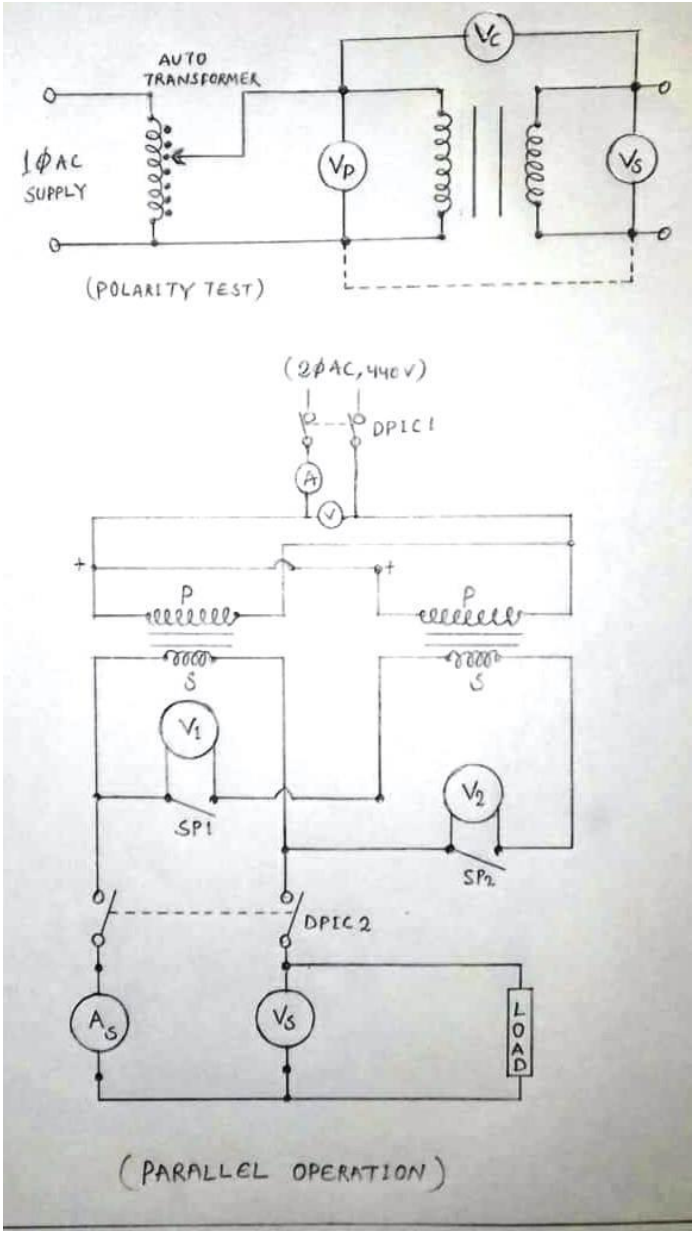
Vc= Vp- Vs

In subtractive polarity if Vc=Vp-Vs then it is a step down transformer. If Vc=Vs-Vp, then it is step up transformer.

→ Additive polarity is used for small scale distribution transformer.

→ Subtractive polarity is used for large scale transformer.

If we have additive polarity and we require subtractive polarity, simply we chain the terminals of one transformer and the polarity will change vice-versa.



(***PARALLEL OPERATION)***

→ For deliver electricity to increased load more than the existing rating of the transformer, one additional transformer is connected in parallel with the ,main transformer. This is called as parallel operation of transformer.

→ Some condition must be fulfilled to run the transformer in parallel as follows:-

- ❖ Polarity of the two transformer must be same.
- ❖ The voltage ratio transformer must be same.
- ❖ The % impedance of the two are must same.
- ❖ The group of transformers must be same.

WORKING PROCEDURE:-

(POLARITY TEST)

→ First collect all the tools, raw materials and gone to transformer step up.

→ Here 1Φ AC will be used.

→ So connect any two phase to DPIC switch and get the output terminals.

→ Find the transformer primary & secondary connect the voltmeter and ammeter according to the circuit diagram.
→ Apply some voltage to primary by on the circuit.
→ Take reading of voltmeter and find out the polarity type.
→

OBSERVATION TABLE FOR POLARITY TEST:-

NO. OF OBS	PRIMAY VOLTAGE(Vp)	SECONDARY VOLTAGE(Vs)	TOTAL VOLTAGE(Vc)	POLARITY TYPE WITH CALCULATION OF Vc

(PROCEDURE FOR PARALLEL OPERATION):-

→ Draw the connection diagram and check it.
→ Before we have to find the terminals and polarity.
→ So now connect the transformers in parallel.
→ Make connection of measuring instruments.
→ Connect the SP switch in secondary side, between the same polarity.
→ Put the DPIC switch ON and put the leads of one voltmeter on the two points of SP switch. If it shows 'zero' the connection is ok. If voltmeter shows some value, then interchange the terminals.
→ Now 'ON' the DPIC at secondary side and take reading for observation.

OBSERVATION TABLE:-

NO. OF OBS	SUPPLY VOLTAGE	IP	IS	VS	TRANSFORMER VOLTAGE(V1)	TRANSFORMER VOLTAGE(V2)	TRANSFORMER VOLTAGE(V3)

CONCLUSION:-

From the above experiment we will able to check polarity of two used transformer, connect both transformer in parallel that is same polarity in primary and secondary. Given supply to primary & take output from secondary and operate the transformer with measuring the current and voltage of polarity operated transformers.