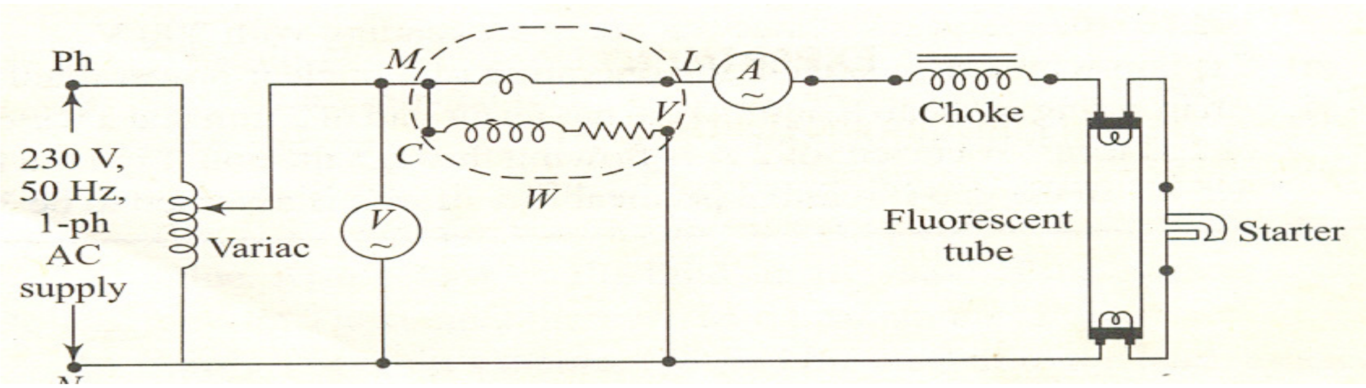
EXPERIMENT NO-1

AIM OF THE EXPERIMENT: Connection and measurement of power consumption of a fluorescent lamp.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Ammeter	0-2A	MI	1
02	Voltmeter	0-300V	MI	1
03	Wattmeter	230V,5/10A	DM	1
04	Choke	40W,230V	IRON CORE	1
05	Starter	230V,50Hz	GLOW	1
06	Fluorescent Tube	40W,230V,50Hz	-	1
07	Variac	1-PH,0-300V,5A	-	1
08	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

Fluorescent lamp constitutes a glass tube whose inside is coated with a fluorescent powder. When the two filaments of the lamp are maintained at potential difference sufficient enough t produce electric discharge through the gap, then electron are emitted from one electrode and move towards the other electrodes. In the mean time, these electrons collide with the fluorescent coating and emit cool light. In most fluorescent lamp, a mixture of argon and mercury gas contained in a glass tube is stimulated by an electric current, producing ultraviolet ray. These rays strike fluorescent phosphorous coating on the interior surface of the bulb. Unfortunately a fluorescent lamp can't just work as is case of incandescent lamp. The main reason is that it is normally takes a voltage greater than the typical line voltage to start. It requires several hundreds of volts (700-800v). The second problem is that

PROCEDURE:

- Do the connection as per the circuit diagram.
- Keep the variac in the zero position and switch on the power supply.

- Increase the variac voltage slowly until the fluorescent tube flickers and glows. Measure the current, voltage, and power.
- Take another 4 sets of ammeter, voltmeter, and wattmeter reading at different positions of variac while the tube is glowing.
- Record the reading in observation table.
- Switch off the power supply.

OBSERVATION TABLE:

SL NO	Voltmeter Reading(V)	Ammeter Reading(A)	Wattmeter Reading(W)	Power Factor

CALCULATION:

(I) Power Factor, Cos ϕ= W/VI.
(II) Calculate mean power factor.

CONCLUSION:

From the above experiment we connected the fluorescent lamp and measured the different values of power and power factors

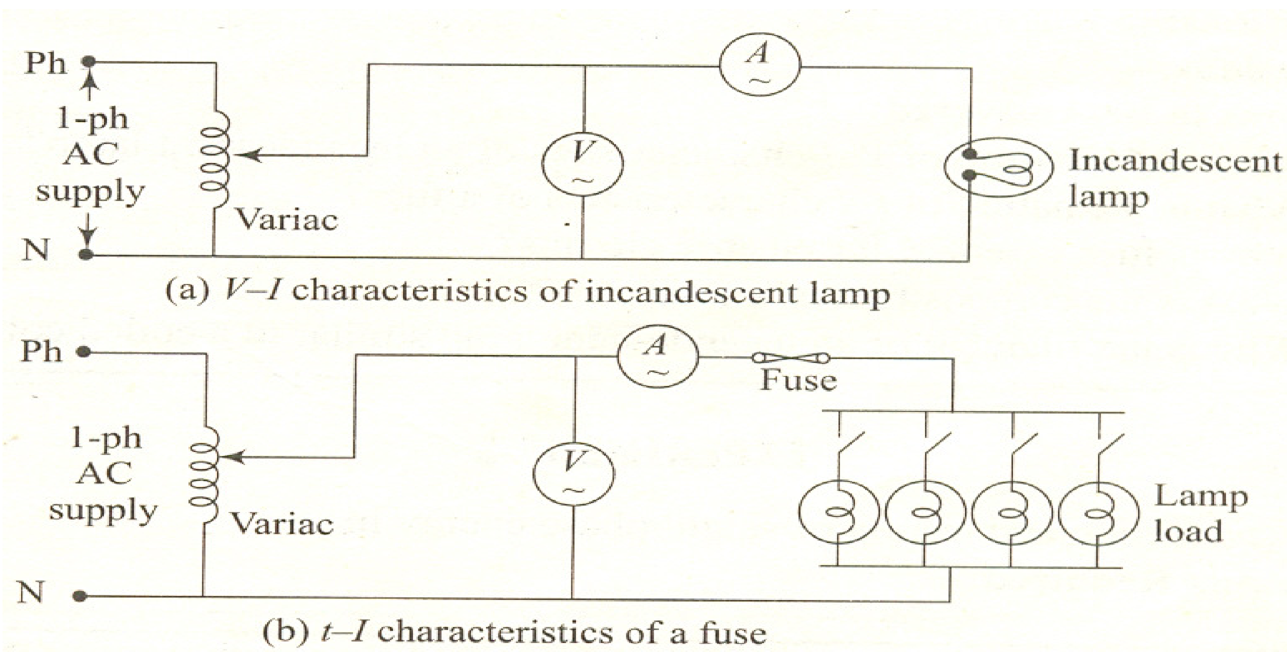
EXPERIMENT NO-2

AIM OF THE EXPERIMENT: V-I Characteristics of incandescent lamp and T-I characteristics of a Fuse.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Ammeter	0-5A	MI	1
02	Voltmeter	0-300V	MI	1
03	Ammeter	0-10A	DM	1
04	Incandescent Lamp	100W,230V	Filament	1
05	Fuse wire	5A	-	1
06	Variable Load	2KW,230V	Rheostatic	1
07	Variac	1-PH,0-300V,5A	-	1
08	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

Incandescent lamp means production of visible light by means of heat that’s way the electric lamp in which light is produced by the principle of heat production is called incandescent lamp. The filament inside the incandescent lamp is simple a resister. If electric power is applied it is converted in to heat. In the filament temperature rises until it gets red. The filament temperature is very high generally over 2000^0C or 3000^0C . In standard incandescent lamp the filament temperature roughly 250^0C or 400^0C. The inert gas such as argon or argon nitrogen mixture slow down the evaporation of the filament. Tungsten atom in evaporation the filament by gas atom. The blackening of the bulb is due to the fact that the linear surface of the bulb just prevents the evaporation of the filament.

PROCEDURE:

- Do the connection as per the circuit diagram.(a)
- Keep the variac in Zero position and switch on the power supply.
- Increase the variac voltage slowly and take five different readings for the current and voltage as per the table-1.
- Switch off power supply.
- Do the connections as per the circuit diagram (b).
- Keep the variac in zero position and adjust load in minimum position. Also switch on the power supply.
- Adjust the variac voltage to rated value and adjust the load current to the rated full load of 5 A. Slowly add 10% extra load. Note the fusing time and load current in the table-2. Switch of the power supply.
- Repeat the previous step with 20%, 30%, and 40-50% extra loading.

OBSERVATION TABLE:

	TABLE-1		TABLE-2	
SL NO	Voltmeter Reading(V)	Ammeter Reading(A)	Time	Current

GRAPHS: Plot the graphs for the voltage versus current corresponding to the observation table-1 and time versus current corresponding to the observation table-2.

CONCLUSION:

At last we connect and measure the voltage and current values of the V-I characteristics and studied the T-I characteristics of the Fuse.

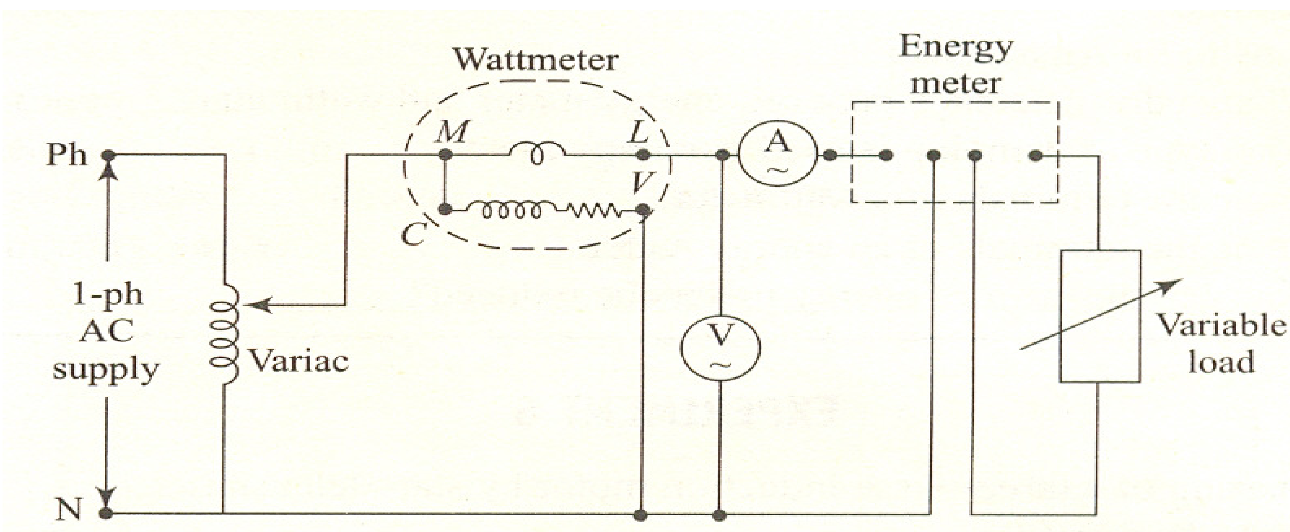
EXPERIMENT NO-3

AIM OF THE EXPERIMENT: Connection and testing of single phase energy meter.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Ammeter	0-5A	MI	1
02	Voltmeter	0-300V	MI	1
03	Wattmeter	230V/5-10-A	DM	1
04	Energy Meter	230V/5-10-A	DM	1
05	Variable Load	2KW,230V	Rheostatic	1
06	Variac	1-PH,0-300V,5A	-	1
07	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

An elec tric energy meter is a device that measure the amount of electric energy to residence, business or machine, that most common type of meter measure in KWh when used in electricity retailing the utilities recorded by the energy meter to generate invoice from the electricity. The most common unit of measurement an electricity meter in KWh.

Types of Meter: (1)Electromechanical Type

(2) Electronics/ Solid Type

Electromechanical Type:- This type of energy meter operated by counting the revolution of an aluminum disc which is made to rotate to a speed proportional to the energy uses. It consumes a small amount of power typically around 2 watt. The metallic disc is acted upon the two coil one connected in such a way that it produce a magnetic flux and proportional to the voltage and the current. The field of the voltage coil is delayed by using a long coil. These produce an AC current in the disc and the effect in such that a force is exerted on the disc is proportional to the product of instantaneous current and voltage. A permanent magnet exert an opposing force proportional to the speed of the rotation of the disc and equilibrium between the two opposing force result in the disc that relating at speed proportional to the power being used. The disc over time by counting revolving such like that. It is a curve order to measurement.

Electronics: This type of energy meter is based on the solid state technology in which power consumption is displayed on a LCD screen.

PROCEDURE:

- Do the connection as per the circuit diagram given in Figure.
- Keep the variac in Zero position and switch on the power supply.
- Increase the variac voltage slowly up to the rated voltage. Switch ON a particular load.
- Note the readings of ammeter, voltmeter and wattmeter.
- Also note the number of revolution of the energy meter disc for a particular time interval.
- Repeat the experiment for different loads and record five sets of readings, switch off the power supply.

OBSERVATION TABLE:

Sl NO	Voltage(V)	Current(I)	Power(W)	Time(Sec)	Revolution

CALCULATION:

(i) W_1=(P×t) J

(ii) W_2=(Revolutions× Joules per revolution)J

(iii) % error=(W_1-W_2/W_1) ×100

CONCLUSION: At last we connect and verified the value of power through the single phase energy meter.

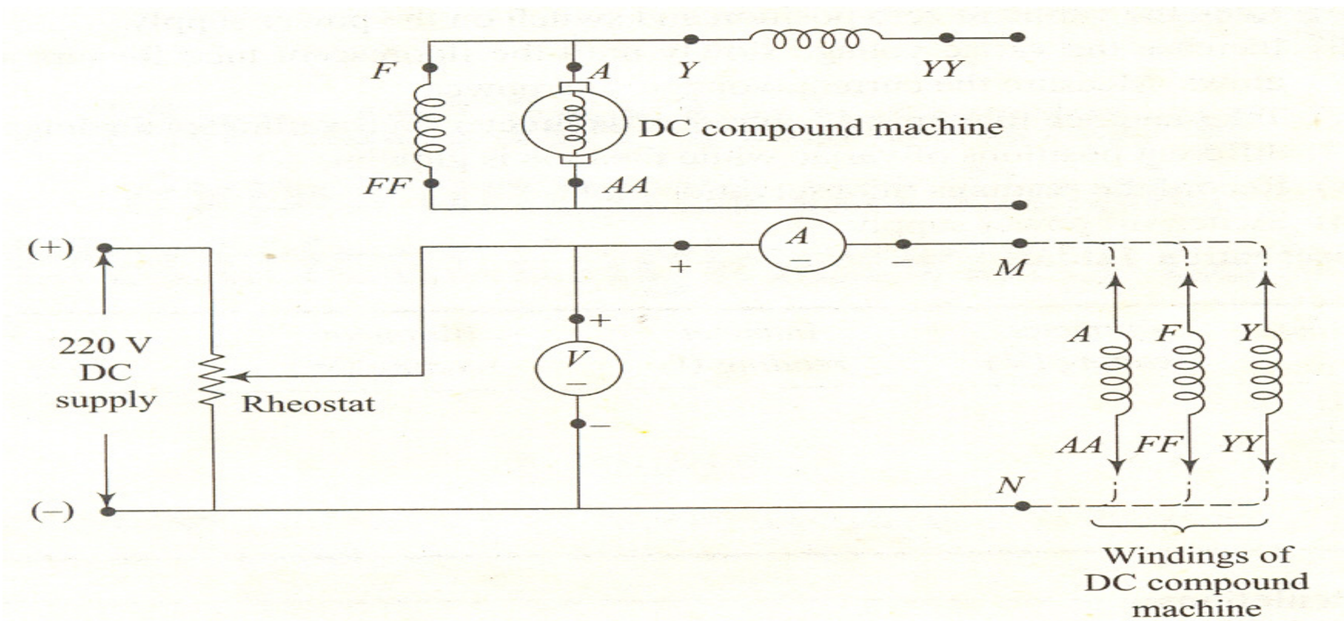
EXPERIMENT NO-4

AIM OF THE EXPERIMENT: Measurement of armature and field resistance of a DC compound Machine.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	DC Machine	1KW,220V	Compound	1
02	Ammeter	0-5A	MI	1
03	Voltmeter	0-300V	MI	1
04	Rheostat	200Ω,3A	1-Tube	1
05	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

Depending on the type of arrangement the family of DC machine is classified into two broad groups like

(i)Separately excited DC Machine

(II) Self Excited DC Machine.

A DC machine whose field magnet winding is supplied from an external DC source is called separately excited DC machine.

A DC machine whose field magnet winding is supplied current from the out pit of the machine itself is called self excited DC machine. it also classified into three groups

(i)Shunt Excited DC Machine

(ii) series excited DC Machine.

(iii)Compound excited DC machine.

In shunt excited DC machine the field winding is connected in parallel across the armature winding.

A series excited DC Machine the field winding connected in series with the armature winding.

A compound wound Dc machine the field winding are connected in both series and in parallel with the armature winding.

PROCEDURE:

- Do the connection as per the circuit diagram shown in the figure.
- Connect the armature winding (A-AA) of the DC machine across M and N of the circuit diagram. Switch ON the DC supply and take 5 sets of reading by varying the rheostat position. Record these reading in table -1 then switch of the DC supply.
- Connect the shunt field winding (F-FF) of the DC machine M and N of the circuit diagram. Switch ON the DC supply and take 5 sets of reading by varying the rheostat position. Record these reading in table -2 then switch of the DC supply.
- Connect the series field winding(Y-YY) of the DC machine M and N of the circuit diagram. Switch ON the DC supply and take 5 sets of reading by varying the rheostat position. Record these reading in table -3 then switch of the DC supply.

OBSERVATION TABLE:

Sl No	Voltmeter(V)	Ammeter(A)	Winding Resistance	Average Resistance
1				

CALCULATION: (i) Winding resistance R=V/I.

(ii) Calculate average for each case.

CONCLUSION: At last we studied about the resistances of the DC machines and calculate the resistances.

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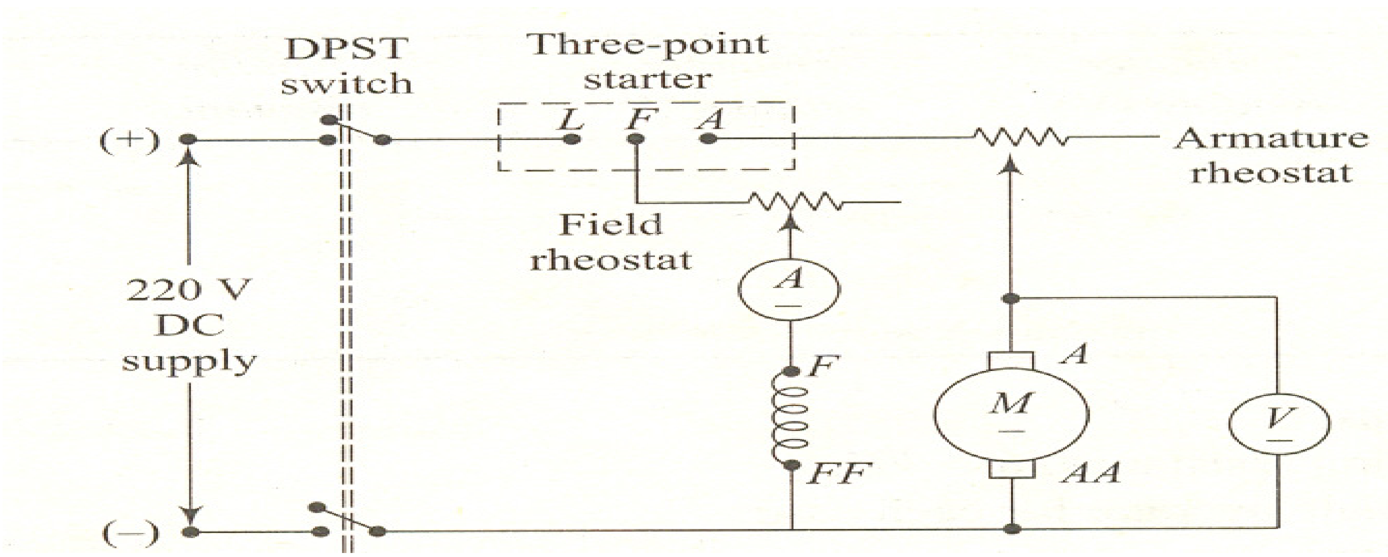
EXPERIMENT NO-5

AIM OF THE EXPERIMENT: Starting and Speed control of DC shunt motor by (a) field flux control method and (b) armature voltage control method.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	DC Machine	1KW,220V	Shunt	1
02	Ammeter	0-5A	MI	1
03	Voltmeter	0-300V	MI	1
04	Rheostat	200Ω,3A	1-Tube	1
05	Rheostat	100Ω,3A	1-Tube	1
06	Tachometer	0-5000rpm	Digital	1
07	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

The speed of a DC motor can be controlled by two method.

- **Field flux control method.**
- **Armature voltage control method.**

__Field flux control Method:__

The speed of a DC motor can be made inversely proportional to the field flux by considering other parameter as fixed. Hence by reducing the flux the speed of Dc motor may be increase beyond the rated speed. A variable external resistance in the field circuit can do this job. Variation in the resistance would change the field current, which in turn would change the field flux. Finally the speed gets control. A circuit diagram for field flux control method is shown below.

Armature voltage control Method:

In the armature voltage control method an external resistance is connected in the armature circuit. Due to this resistance, a voltage drop in the armature circuit increased and hence, the beck emf tends to reduce in strength. The follow-up action for this may be verified from equation. As result of this, the speed tends to decrease below the rated speed. A circuit diagram for armature voltage control method is shown below.

PROCEDURE:

- Do the connection as per the circuit diagram. Keep both the rheostat at their minimum resistance position.
- Start the DC shunt motor with the help of 3-point starter. Increase the resistance of the rheostat connected in the field circuit. Do not change the armature circuit rheostat at all. Observe the increase in motor speed record five sets of readings in table -1, the switch of the DC supply and bring the field circuit rheostat to minimum.
- Start the DC shunt motor with the help of 3-point starter. Increase the resistance of the rheostat connected in the armature circuit. Do not change the field circuit rheostat at all. Observe the decrease in motor speed record five sets of readings in table -2, the switch of the DC supply and bring the armature circuit rheostat to minimum.

OBSERVATION TABLE:

Table-1			Table-2	
Sl no	**Speed**	**Field Current**	**Speed**	**Armature Voltage**

GRAPHS: Plot the graphs for speed versus field current and speed versus armature voltage.

CONCLUSION: At last we studied about the speed control of the DC machines and verified the speed-voltage and speed-current characteristics.

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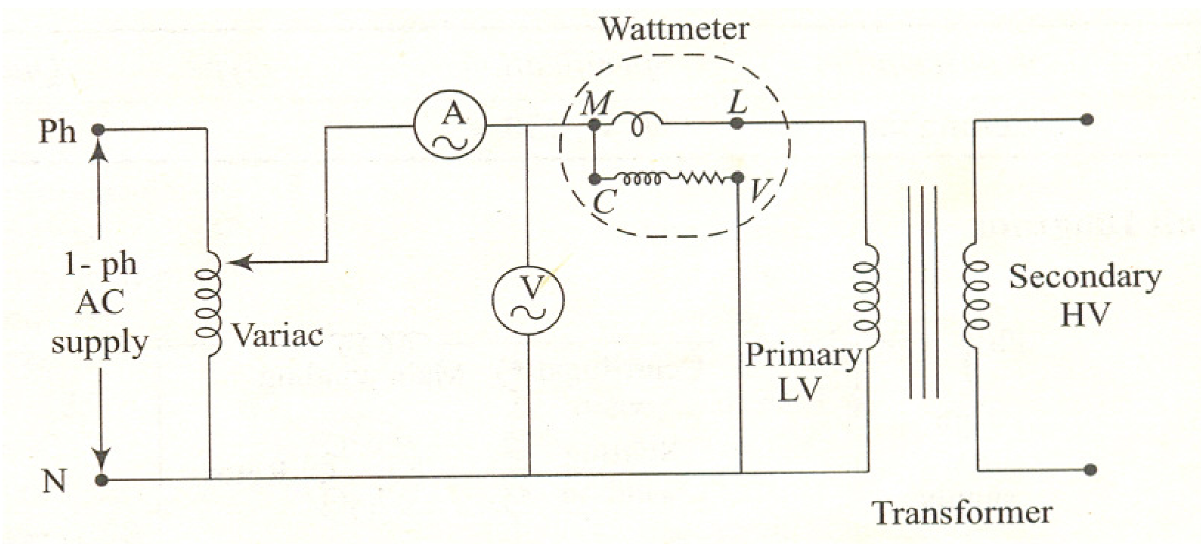
EXPERIMENT NO-6

AIM OF THE EXPERIMENT: Calculation of no load losses of a single phase Transformer.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Transformer	0.5KVA,1:1	Core, 1-Φ	1
02	Ammeter	0-10A	MI	1
03	Voltmeter	0-300V	MI	1
04	Variac	1-Φ,0-300V	-	1
05	Wattmeter	230V,10A	DM	1
06	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:



THEORY:

A transformer is an electrical device that transfers energy between two circuits through electromagnetic induction without changing the frequency. A transformer may be used as a safe and efficient voltage converter to change the AC voltage at its input to a higher or lower voltage at its output. Other uses include current conversion, isolation with or without changing voltage and impedance conversion.

A transformer most commonly consists of two windings of wire that are wound around a common core to provide tight electromagnetic coupling between the windings. The core material is often a laminated iron core. The coil that receives the electrical input energy is referred to as the primary winding, while the output coil is called the secondary winding.

An alternating electric current flowing through the primary winding (coil) of a transformer generates a varying electromagnetic field in its surroundings which causes a varying magnetic flux in the core of the transformer. The varying electromagnetic field in the vicinity of the secondary winding induces an electromotive force in the secondary winding, which appears a voltage across the output terminals. If a load impedance is connected across the secondary winding, a current flows through the secondary winding drawing power from the primary winding and its power source.

A transformer cannot operate with direct current; although, when it is connected to a DC source, a transformer typically produces a short output pulse as the current rises.

Winding joule losses

Current flowing through winding conductors causes joule heating. As frequency increases, skin effect and proximity effect causes winding resistance and, hence, losses to increase.

Core losses

Hysteresis losses

Each time the magnetic field is reversed, a small amount of energy is lost due to hysteresis within the core.

Eddy current losses

Ferromagnetic materials are also good conductors and a core made from such a material also constitutes a single short-circuited turn throughout its entire length. Eddy currents therefore circulate within the core in a plane normal to the flux, and are responsible for resistive heating of the core material. The eddy current loss is a complex function of the square of supply frequency and inverse square of the material thickness.[34] Eddy current losses can be reduced by making the core of a stack of plates electrically insulated from each other, rather than a solid block; all transformers operating at low frequencies use laminated or similar cores.

PROCEDURE:-

- **Do the connection as per the circuit diagram.**
- Switch on the ac supply and adjust the variac to rated output voltage.
- Keeping secondary as open, take one set of reading.
- Switch off the AC power supply.

OBSERVATION TABLE:-

SL NO	VOLTAGE	CURRENT	POWER	POWER FACTOR

CALCULATION:- **Power factor =cos ϕ =W/VI**

CONCLUSION:- : At last we studied about the application of transformer and verified the losses and open circuit test.

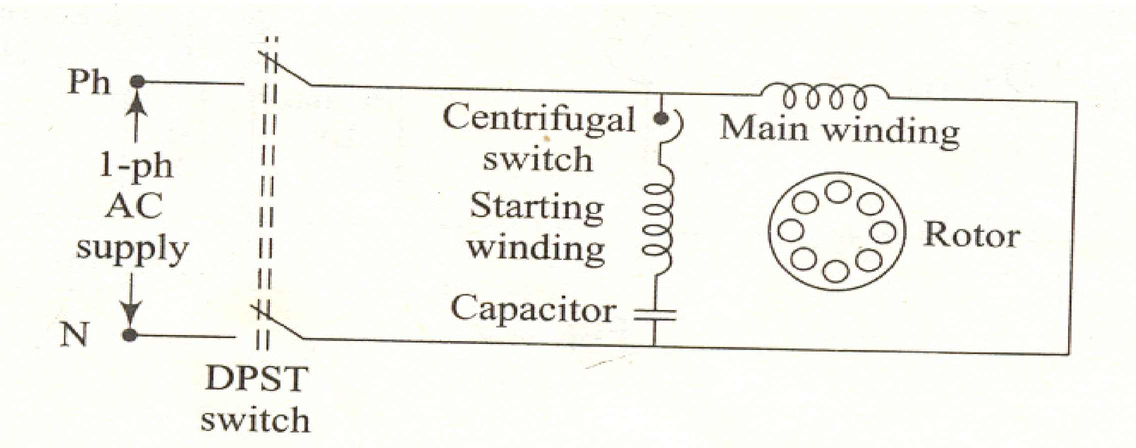
EXPERIMENT NO-7

AIM OF THE EXPERIMENT:- Study of single phase induction motor/ fan motor.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Single phase Motor	80W, 230V	--	1
02	Plier	Insulated	--	1

CIRCUIT DIAGRAM:-



THEORY:- An **induction** or **asynchronous motor** is an AC electric motor in which the electric current in the rotor needed to produce torque is induced by electromagnetic induction from the magnetic field of the stator winding. An induction motor therefore does not require mechanical commutation, separate-excitation or self-excitation for all or part of the energy transferred from stator to rotor, as in universal, DC and large synchronous motors. An induction motor's rotor can be either wound type or squirrel-cage type.

Three-phase squirrel-cage induction motors are widely used in industrial drives because they are rugged, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans.

The method of changing the direction of rotation of an induction motor depends on whether it is a three-phase or single-phase machine. In the case of three phase, reversal is carried out by swapping connection of any two phase conductors. In the case of a single-phase motor it is usually achieved by changing the connection of a starting capacitor from one section of a motor winding to the other. In this latter case both motor windings are similar (e.g. in washing machines).

PROCEDURE:-

- Open the cover of the celling fan.
- Identify the rotor winding.
- Observe the constructional details.

CONCLUSION:- : At last we studied about the application of single phase induction motor and studied the various parts of celling fan.

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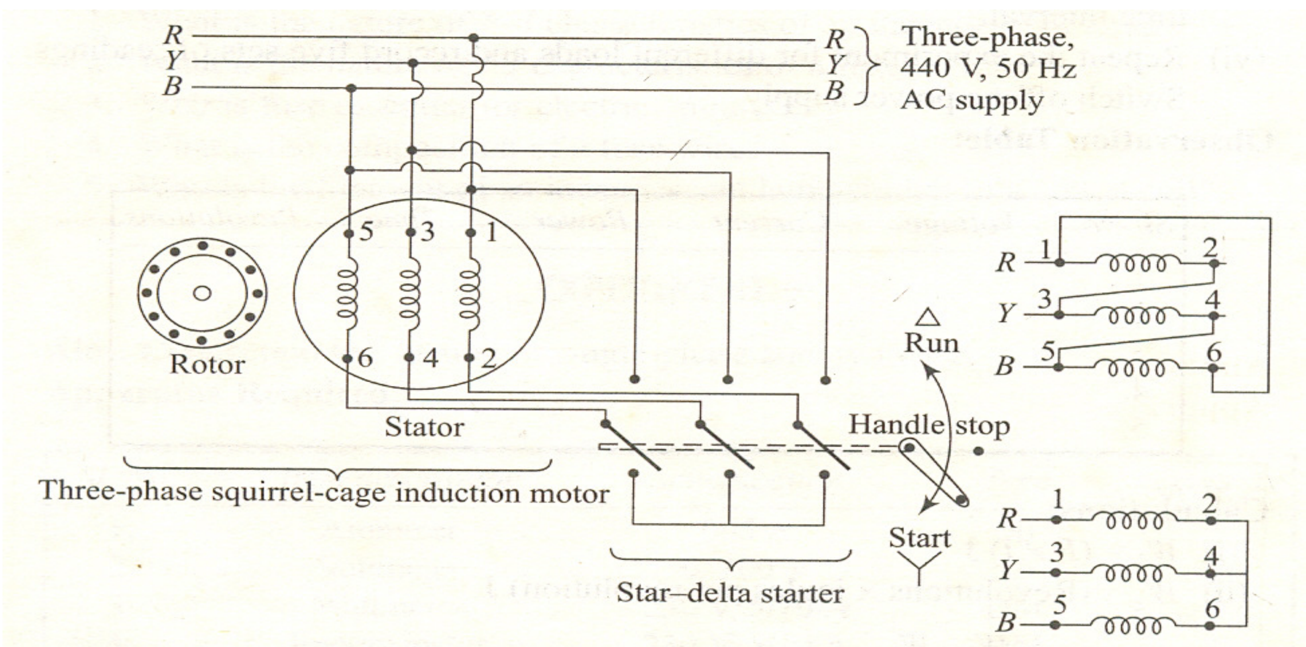
EXPERIMENT NO-8

AIM OF THE EXPERIMENT:- Starting of a three phase induction motor by star delta starter.

APPARATUS REQUIRED:

SL NO	ITEM DESCRIPTION	SPECIFICATION	TYPE	QUANTITY
01	Three phase induction motor	2KW,440V,50Hz	Squirrel cage	1
02	Ammeter	0-10A	MI	1
03	Voltmeter	0-500V	MI	1
04	Tachometer	0-10000	Digital	1
05	Connecting Wire	3/20SWG	PVC	LS

CIRCUIT DIAGRAM:-



THEORY:-

An **induction** or **asynchronous motor** is an AC electric motor in which the electric current in the rotor needed to produce torque is induced by electromagnetic induction from the magnetic field of the stator winding. An induction motor therefore does not require mechanical commutation, separate-excitation or self-excitation for all or part of the energy transferred from stator to rotor, as in universal, DC and large synchronous motors. An induction motor's rotor can be either wound type or squirrel-cage type.Three-phase squirrel-cage induction motors are widely used in industrial drives because they are rugged, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. There are five basic types of competing small induction motor: single-phase capacitor-start, capacitor-run, split-phase and shaded-pole types, and small polyphase induction motors.A single-phase induction motor requires separate starting circuitry to provide a rotating field to the motor. The normal running windings within such a single-phase motor can cause the rotor to turn in either direction, so the starting circuit determines the operating direction.In certain smaller single-phase motors, starting is done by means of a shaded pole with a copper wire turn around part of the pole. The current induced in this turn lags behind the supply current, creating a delayed magnetic field around the shaded part of the pole face. This imparts sufficient rotational field energy to start the motor. These motors are typically used in applications such as desk fans and record players, as the required starting torque is low, and the low efficiency is tolerable relative to the reduced cost of the motor and starting method compared to other AC motor designs.Larger single phase motors have a second stator winding fed with out-of-phase current; such currents may be created by feeding the winding through a capacitor or having it receive different values of inductance and resistance from the main winding. In *capacitor-start* designs, the second winding is disconnected once the motor is up to speed, usually either by a centrifugal switch acting on weights on the motor shaft or a thermistor which heats up and increases its resistance, reducing the current through the second winding to an insignificant level. The *capacitor-run* designs keep the second winding on when running, improving torque.Self-starting polyphase induction motors produce torque even at standstill. Available cage induction motor starting methods include direct-on-line starting, reduced-voltage reactor or auto-transformer starting, star-delta starting or, increasingly, new solid-state soft assemblies and, of course, VFDs.[31]Polyphase motors have rotor bars shaped to give different speed-torque characteristics. The current distribution within the rotor bars varies depending on the frequency of the induced current. At standstill, the rotor current is the same frequency as the stator current, and tends to travel at the outermost parts of the cage rotor bars (by skin effect). The different bar shapes can give usefully different speed-torque characteristics as well as some control over the inrush current at startup.In wound rotor motors, rotor circuit connection through slip rings to external resistances allows change of speed-torque characteristics for acceleration control and speed control purposes.

PROCEDURE:-

- **Do the connection as per the circuit diagram.**
- **Move the starter knob to start position and that the induction motor start rotating.**
- **As the motor attains more than 60% of the rated speed, change the starter knob to delta position. The induction motor continues to run.**

- **Note the readings of the ammeter, voltmeter, and ammeter and tachometer during starting and running.**

OBSERVATION TABLE:-

SL NO	VOLTAGE	CURRENT	SPEED	REMARK

CALCULATION:-

% Slip = (Ns-Nr)/Ns ×100

CONCLUSION:- At last we studied about the application of three phase induction motor and studied the various parts of star delta starter.