EXPT .1: SCOTT CONNECTION OF TRANSFORMERS

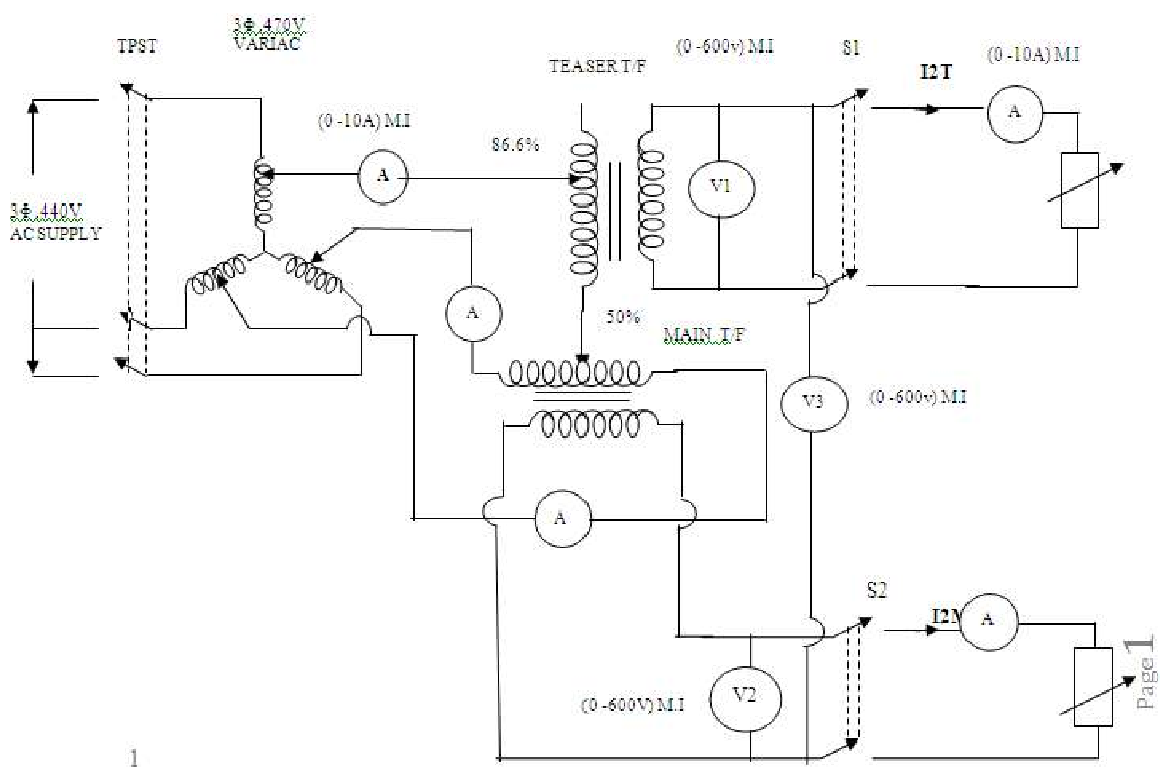
AIM : To study the conversion of three phase supply to two phase supply by using scott connected transformers

NAME PLATE DETAILS:

EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	TYPE	RANGE	
1	Ammeter	MI	0-10A	5
2	Voltmeter	MI	0-600V	3
3	3 Ø Variac	MI	0-470V	1
4	Transformers		415V /230V	2
5	Loading Rheostat			

CIRCUIT DIAGRAM :



PROCEDURE:

The step wise procedure for conducting this experiment is given below :

1. Verification of 2phase supply
    1. Connect the circuit as shown in figure
    2. The switches connecting the load to the two secondaries say S1 & S2 should be kept open.
    3. Set the three phase variac on the primary side to its minimum value .
    4. Switch on three phase supply and set the output of the three phase variac to the rated value of the primaries .
    5. Record the readings of voltmeter V1 ,V2 & V3 .Verify the output is a balanced two phase supply .
2. Equal Loading on the two secondaries**:**
    1. Adjust 3 phase variac to its minimum value &Switch off the 3 phase supply .
    2. Remove the dotted connection of two secondaries i.e remove V3
    3. Switch on the three phase supply & adjust the output voltage of the 3phase variac to rated value of the primaries of the transformers
    4. Now close the switches S1 & S2 .Both the secondaries should be loaded equally .
    5. Record the readings of all the meters connected on primaries as well as secondaries .
    6. Repeat step 4 & 5 for various values of equal loadings on the two secondaries .
    7. Switch off the 3 phase supply .

PRECAUTIONS :

1. Scott connection should be performed with two transformers at 50% & 86.6%
2. The voltmeter and ammeter should be carefully chosen so that their ranges are more than max. Values to be measured.

CALCULATIONS:

$$V3 = \sqrt{(V1^2 + V2^2)}$$

OBSERVATIONS:

S. no	For balanced 2 phase supply				
	INPUT		OUTPUT		
	V1M	V1T	V2M(V2)	V2T(V1)	V3

Loaded Conditions :

I2M	I 2T	I1	I2	I3	V1(V2T)	V2 (V2M)

RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA :

1. What is the use of Scott connected transformers ?
2. What are the special conditions to be satisfied by the transformers ?
3. Where does the Scott connection find its use ?
4. What phase difference should exist in two secondary voltages if two identical transformers are connected in Scott ?
5. Are the two transformers connected for Scott connections coupled magnetically ?
6. Can a 3 phase supply be converted to 1 phase supply using transformers ?

EXPT2: PERFORMANCE CHARACTERISTICS OF SINGLE PHASE INDUCTION MOTOR

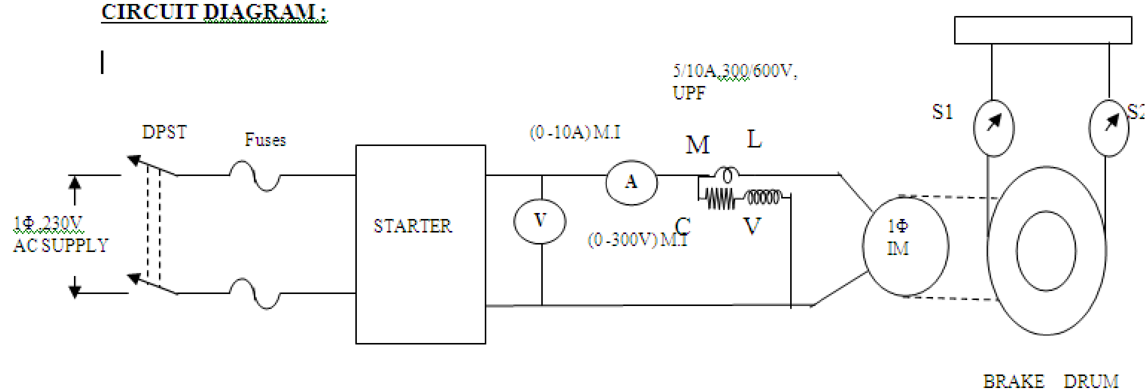
AIM : To perform load test on single phase induction motor .

NAME PLATE DETAILS

EQUIPMENTS REQUIRED:

SL.NO	NAME	TYPE	RANGE	QUANTITY
1	Voltmeter	M.I	0-300V	1
2	Ammeter	M.I	0-10A	1
3	Wattmeter	M.I	5/10A , 150V /300V UPF	1
4	Tachometer			1
5	Connecting wires			

CIRCUIT DIAGRAM :



PROCEDURE:

1. Connect the apparatus as per the circuit diagram.
2. Switch on the supply & start the motor with the help of starter on no load.
3. Adjust the speed up to the rated value note down the no-load readings of the meters.
4. Gradually increase the brake load and note down the readings and speed for different set of steps up to rated value.
5. Mean while pour water into the drum pulley for cooling.
6. After the observations of all readings reduce the load gradually and stop the motor on no-load.

OBSERVATIONS:

S. no	V (volts)	I_L (amp)	W (watts)	N (rpm)	Brake load		Torque (N-m)	Output	Input(Wattmeter Reading)	Efficiency
					S_1	S_2				
1										
2										
3										
4										
5										

FORMULAES:

- Torque = (s1-s2)*R*g in N-m. where R- Radius of brake drum.
- Output= (2∏NT)/60 in watts.
- Efficiency(%)=(output/input)*100
- Input= Wattmeter Reading

SAMPLE CALCULATIONS:

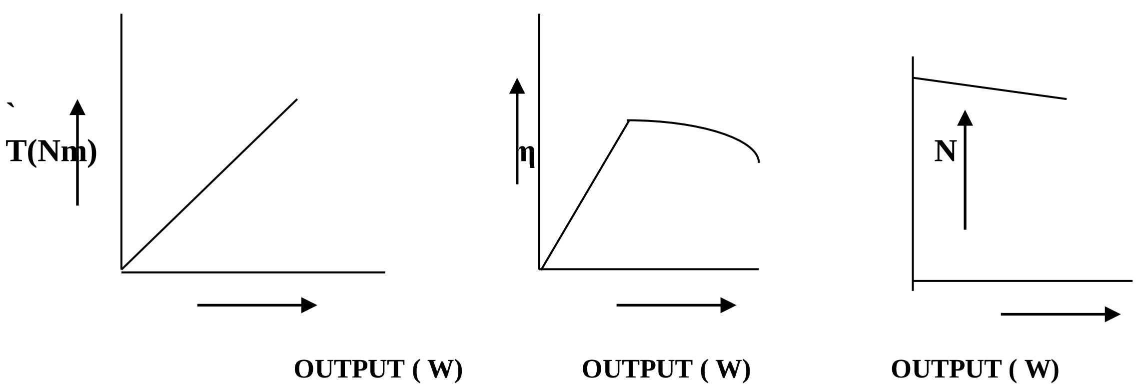
PRECAUTIONS:

- All the connections should be clear and tight.
- The voltmeter and ammeter should be carefully chosen so that their ranges are more than max. Values to be measured

GRAPH:

Output vs efficiency.
- Torque vs output.
- Speed vs output.

EXPECTED GRAPH:



RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA:

1. why 1 phase induction motor is not self starting ?
2. Mention the purpose of providing capacitor in auxillary winding of a split phase induction motor
3. How can you reverse the direction of rotation of induction motor ?
4. In a split phase why running winding is designed to have large X/R ratio & starting winding is designed to have low X/R ratio ?
5. Why high speed motors are usually fractional H.P motors ?
6. Explain why the starting current of a resistance start motor is not an objectional feature ?
7. Explain the reason why the starting winding is disconnected once slip reaches 0.25 or less?

EXPT 3:NO LOAD & BLOCKED ROTOR TEST & LOAD TEST ON 3 PHASE INDUCTION MOTOR

AIM: To conduct no load test & blocked rotor test on 3 phase induction motor and predetermine its performance by drawing circle diagram .

NAME PLATE DETAILS:

INDUCTION MOTOR

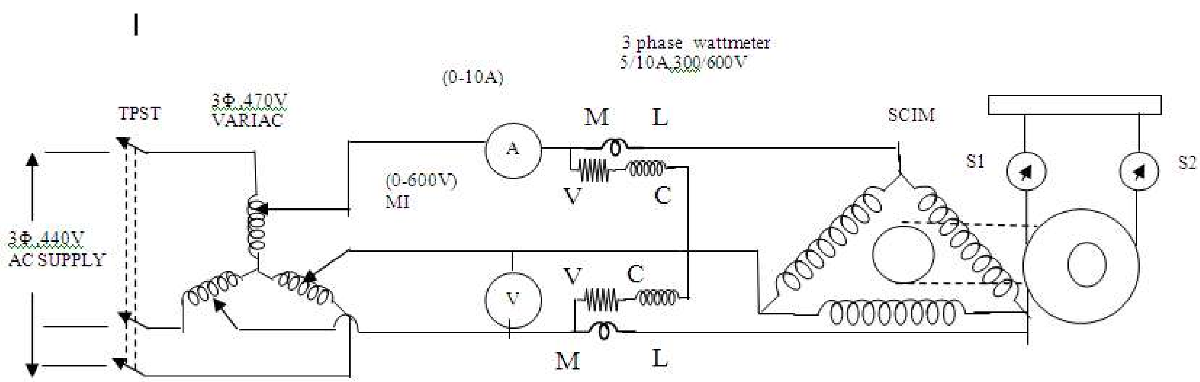
volts-------------- Amps ----------------

power--------------- speed---------------------

APPARATUS REQUIRED:

SL.NO	NAME OF EQUIPMENT	TYPE	RANGE	QUANTITY
1.	Ammeter	M.I	0-10A	**1**
2.	Voltmeter	M.I	0-600V	1
3.	3Φ Wattmeter	MI	5/10A/300/600V	1
4	Tachometer			1
5	3 phase variac	M.I	0-470V	1

CIRCUIT DIAGRAM :



PROCEDURE:

NO LOAD & BLOCKED ROTOR TEST

1. Make the connection as shown in figure
2. Before starting the experiment keep the phase variac in zero voltage conditions
3. For no load or open circuit test ,by adjusting auto transformer apply rated voltage and note the values of ammeter , voltmeter & wattmeter readings
4. In this test the rotor is free to rotate .
5. For rotor blocked test , the induction motor is blocked by brake and low voltage is applied by means for 3 phase variac until rated current flows
6. Note the values of ammeter , voltmeter & wattmeter readings

LOAD TEST

1. For Load test the circuit diagram is same .
2. Switch on the supply & start the motor with the help of starter on no load.
3. Adjust the speed up to the rated value note down the no-load readings of the meters
4. Gradually increase the brake load and note down the readings and speed for different set of steps up to rated value.
5. Mean while pour water into the drum pulley for cooling.
6. After the observations of all readings reduce the load gradually and stop the motor on no load

OBSERVATIONS AND CALCULATIONS:

No load test			Blocked rotor test		
V0 (volts)	Io (Amps)	Po (watts)	V s(volts)	I s (Amps)	Ps (Watts)

Load Test

S. no	V (volts)	I_L (amp)	W (watts)	N (rpm)	Brake load		Torque (N-m)	Output	Input(Wattmeter Reading)	Efficiency
					S_1	S_2				
1										
2										
3										

STEPS TO DRAW CIRCLE DIAGRAM :

1. Draw the lines by taking `the current (I) on X axis and voltage (V) on Y axis .

2. From the No load test find out the no load P.F angle by using the formula **Cos** Φo = Woc / ($\sqrt{3}$ Vo Io) and draw the vector OA with the magnitude of Io lagging V by an angle Φo by choosing suitable current scale

3. From the current I sc find out the I_{SN} (short circuit current corresponding to normal voltage) through the formula I_{SN} = Isc (V rated / Vsc) draw vector OB with magnitude of I_{SN} from the origin by the same current scale which lags the voltage axis by an angle **Cos** Φsc = Wsc / $\sqrt{3}$ Vsc Isc)

3. Join points A and B to get output line

4. Through A draw AL parallel to X axis

5. For finding the centre of the circle draw a perpendicular bisector of line AB .Extend it to meet AL at C

6. With centre as C and radius AC draw a semicircle

7. Draw perpendicular lines from points A & B on X axis as AD and BK

8. BK cuts the the horizontal line AL at N such that NK = AD

9. AD represents No Load input which supplies friction ,core & windage losses .

10. BK represents the power input when the rotor is blocked which meets core losses ,stator & rotor copper losses From BK find power scale .

11. Out of this total power BK ,NK = AD represents fixed losses and BN represents sum of stator & Rotor copper losses .

12. The point E is located as follows :
    The line AE is known as torque line or rotor input line .
    Stator copper losses = $3 \, Is^2 R_1$
    Rotor copper losses = $Ws - 3 \, Is^2 R_1$

For SCIM $\frac{BE}{EN} = \frac{Ws - 3 \, Is^2 R_1}{3 \, Is^2 R_1}$

For SRIM $\frac{BE}{EN} = \frac{R_2}{R_1} \left(I_2 / I_1 \right)^2$

R_2 & R_1 can be determined , I_2 & I_1 can be determined by using two ammeter both in stator & rotor circuits .

13. Any point on the circle represents the stator current .Let it be P .Draw perpendicular from P to OM

Then QR = fixed losses
RS = stator copper losses
ST = rotor copper losses
PT = rotor output
SP = rotor input
PQ = total motor input
η = PT / PQ
Slip = ST / SP
PF = PQ / OP

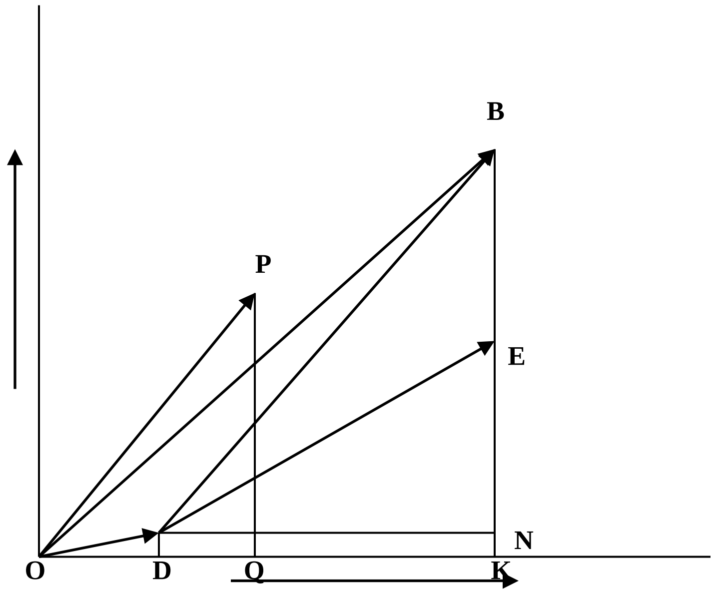
14. Maximum Quantities :

a) Maximum Torque : If a line is drawn parallel to torque line AE and tangential to semicircle ,then vertical intercept FG between tangential line torque line represents maximum torque

b) Maximum output : If a line parallel to output line AB and tangential to semicircle then vertical intercept between the tangential line and output line represents maximum output .

c) Maximum input : It occurs at the highest point of semi circle at point J where tangent to the circle is horizontal .Thus maximum input = JK

GRAPH:



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PRECAUTIONS:

- All the connections should be clear and tight.
- The voltmeter and ammeter should be carefully chosen so that their ranges are more than max. Values to be measured.
- During the experiment the speed of prime mover should remain constant.

GRAPHS:

Draw circle diagram with suitable scale & obtain the following :

a) Max . torque , Max output , Max. input & Max. efficiency
b) Full load values of current , p.f , slip , efficiency

RESULTS: Compare the results of Efficiency ,slip ,p.f at any load & tabulate the results

DISCUSSIONS OF RESULTS (INFERENCE)

VIVA:

1. What purpose is served by performing no load & blocked rotor tests on 3 phase induction motor ?
2. How does the no load current drawn by 3 phase induction motor differs from that of a transformer?
3. Why the p.f of 3 phase induction motor under no load is quite low ?
4. For drawing circle diagram for a 3 phase induction motor we need current under blocked rotor conditions with full voltage applied to stator winding .Why do we then need to perform experiment under reduced voltage?
5. Out of the two input p.fs under blocked rotor and no load which one is higher ?
6. If the rotor windings of a wound rotor induction motor are kept open ,can we perform the blocked rotor test on this machine ?
7. How can you calculate the equivalent circuit parameters of induction motor with the help of these tests ?

EXPT4:REGULATION OF ALTERNATOR BY SLIP TEST

AIM: To determine Xd & Xq of a salient pole alternator by slip test & calculate its regulation at 0.6 ,0.8 P.F Lag & UPF

NAME PLATE DETAILS:

D.C. Shunt Motor Alternator

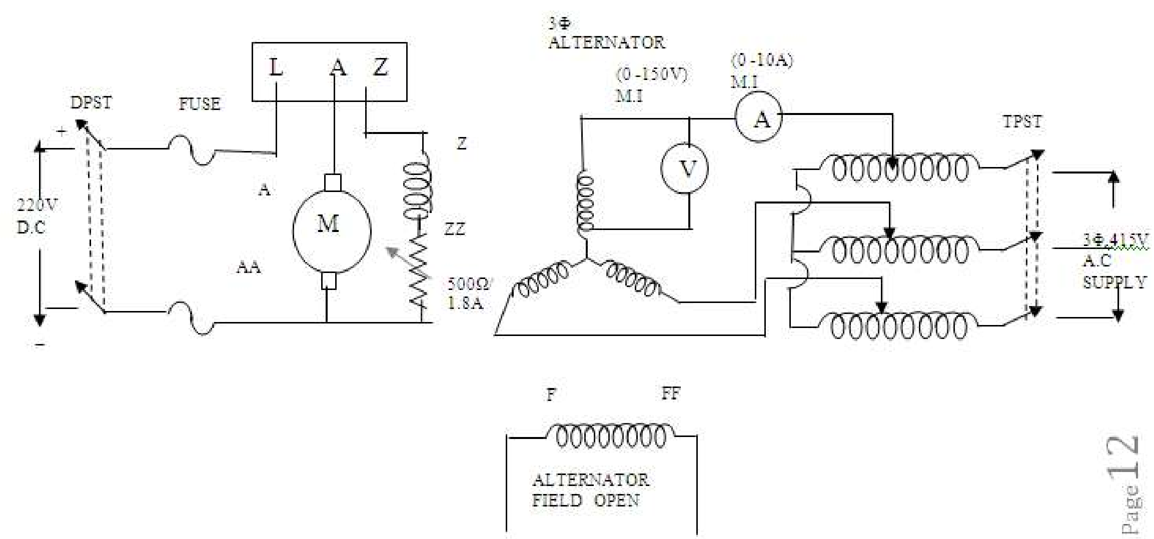
volts-------------- Amps ----------------

power--------------- speed---------------------

APPARATUS REQUIRED:

SL.NO	NAME OF EQUIPMENT	TYPE	RANGE	QUANTITY
1	Ammeter	M.I	0-10 A	1
2	Voltmeter	M.I	0-150V	1
3	Rheostat		500Ω/1.8A	1
4	Tachometer			1

CIRCUIT DIAGRAM :



PROCEDURE:

1. Connections are made as per the circuit diagram
2. Give the DC Supply by closing DPST switch and adjust the speed of alternator by varying resistance in field circuit of motor
3. Slip should be extremely small i.e the speed is reduced slightly less than Ns
4. Ensure that the setting of 3 Φ variac is at zero position
5. Apply 20% to 30% of rated voltage to the armature of alternator by adjusting 3Φ variac such that the current in stator winding is full load current
6. Now, reduce the speed of alternator gradually and observe the current in the stator fluctuates from maximum to minimum values
7. Maximum & Minimum current and voltages are noted
8. Reduce the applied voltage to the stator winding of the alternator and switch off the AC supply
9. Decrease the speed of DC motor and switch off the supply .
10. Calculate Xd = V max / Imin and Xq = Vmin / Imax

PRECAUTIONS:

- All the connections should be clear and tight.
- The voltmeter and ammeter should be carefully chosen so that their ranges are more than max. Values to be measured.
- Slip should be as small as possible .

OBSERVATIONS:

SNo	N (rpm)	Imax (A)	Imin (A)	Vmax(V)	Vmin(V)	Xd (Ω)	Xq (Ω)

SAMPLE CALCULATIONS:

Calculate % regn by using the following formulaes :P

$$\tan \Psi = (V_t \sin\Phi + I_a X_q) / (V_t \cos \Phi + I_a R_a)$$

$$\Psi = \delta + \Phi$$

$$E_o = V_t \cos \delta + I_d X_d + I_q R_a$$

$$\% \text{ regn} = (E_o – V / V)\ 100$$

RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE)

Viva:

1. What do you understand by direct axis & quadrature axis reactance ?
2. What is the usual value of Xq/ Xd fro salient pole machine ?
3. Why the rotor field circuit is kept open while performing the slip test on synchronous machine ?
4. Slip test is conducted on asynchronous machine first with 50Hz and then with 60Hz supply .Will Xq obtained differ ?
5. What voltage should be applied to the stator windings of the machine for conducting slip test ?

EXPT 5: SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

AIM: To vary the speed of 3Φ Slip ring Induction motor by

a)Adding External resistance in rotor circuit b) Cascade Connection

NAME PLATE DETAILS:

Induction Motor

volts-------------- Amps ----------------

power/HP --------------- speed---------------------

APPARATUS REQUIRED:

SL.NO	NAME OF EQUIPMENT	RANGE	QUANTITY
1	M.C. Voltmeter	0-600V	1
2	Rheostat	25Ω	3
3	Tachometer		1
4	3Φvariac	(0-470V)	1

CIRCUIT DIAGRAM:

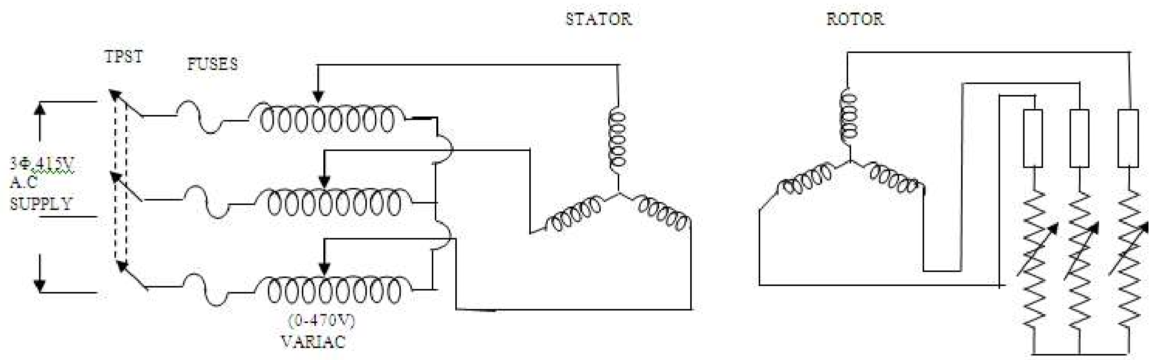


Figure 1

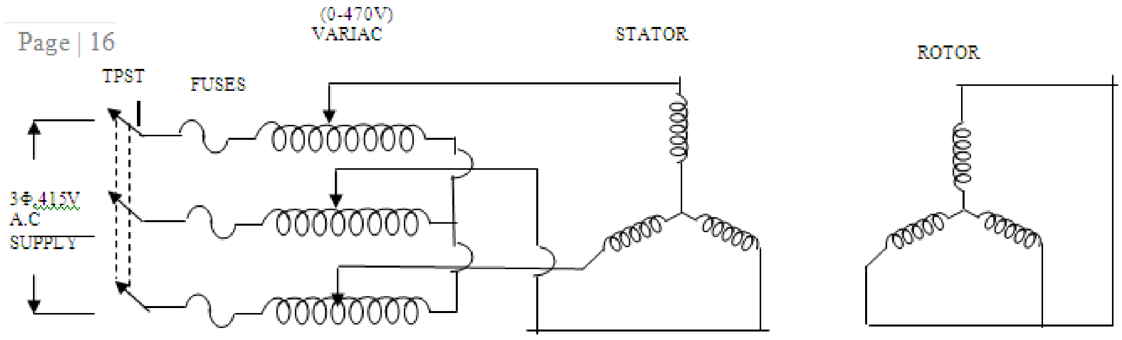


Figure 2 CIRCUIT DIAGRAM FOR INDEPENDENT MOTOR WITH EITHER 4 POLES/2 POLES

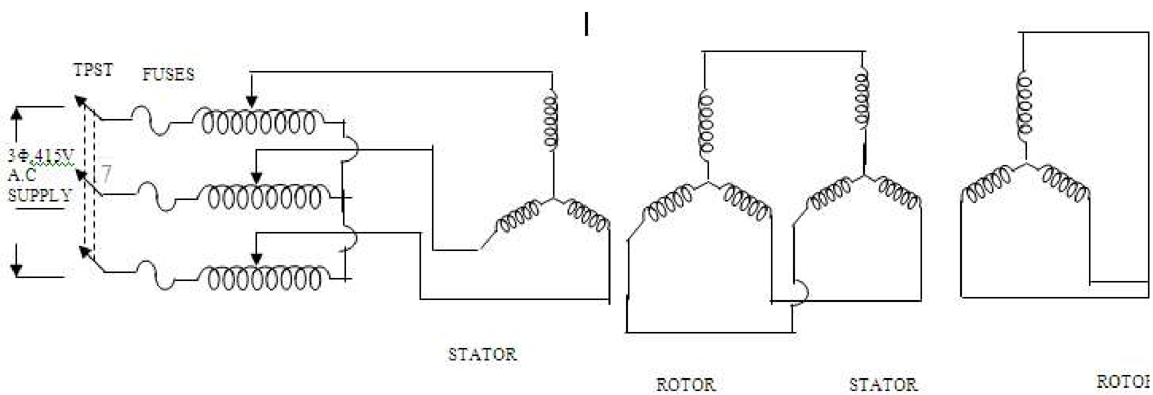


Figure 3 CIRCUIT DIAGRAM FOR CASCADE CONNECTION

PROCEDURE:

a) **External Rotor Resistance**

1. Make the connections as per the diagram, choosing the meters suitable to the ratings of the machines.
2. Start the motor by means of 3Φ variac

3. Vary the rotor resistance in steps and take readings of speed ,voltmeter & ammeter

b) Cascade Control:

1. Make the connections as shown in fig 2
2. Start the motor and note down the value of Nr by using a tachometer
3. Calculate the % slip
4. Then make the connections as per the fig 3
5. Run the motor and note down the value of Nr using tachometer
6. Calculate the % slip as shown .
7. Tabulate the values for different poles as shown

OBSERVATIONS:

a) External Rotor Resistance

S.NO	Resistance (Ω)	Speed (N) R.p.m	Slip (%)

OBSERVATIONS:

b) Cascade connection :

S.NO	Poles	Synchronous Speed (Ns) r.p.m	Rotor Speed (Nr) r.p.m	Slip (%)

PRECAUTIONS:

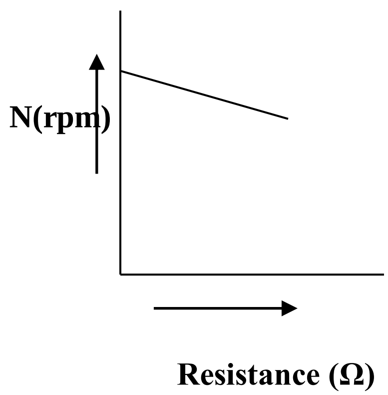
- All the connections should be clear and tight.
- The voltmeter and ammeter should be carefully chosen so that their ranges are more than max. Values to be measured.

- The field current should not be increased to cross rated value.

GRAPHS:

- Plot the following graphs
  Resistance Vs speed.

EXPECTED GRAPH :



RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

Viva:

1. How many speeds can be obtained with the help of cascade connections of two 3 Φ Induction motors ?
2. In which type of cascade connections the cascaded set of motors have higher speeds ?
3. Is there any restriction on the number of poles of IM used for cascading ?
4. Two IMs having 4 poles & 6poles are used for cascade connections .If the supply is 50Hz what are the different speeds which can be obtained with this arrangement ?
5. What is the frequency of stator input of auxillary motor ?

EXPT 6 : VOLTAGE REGULATION OF ALTERNATOR

AIM : To determine the voltage regulation of the given alternator by synchronous impedance method , Ampere Turn & ZPF or Potier Triangle method at F.L at any given P.f & compare the results

NAME PLATE DETAILS:

EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	RANGE	Type	QUANTITY
1	Voltmeter	0-300V	M.I	1
2	Ammeter	0-10A	M.I	1
3	Rheostat	1000Ω/1A 500Ω/1.8A		1
4	Ammeter	0-2A	M.C	1
6	Tachometer			1
7	Connecting wires			
8	Inductive load			

PROCEDURE :

OPEN CIRCUIT TEST :

1 Connect the circuit in as shown in fig 1
2 By increasing the excitation gradually note the field current I_f and generated voltage of the alternator.
3 Record the readings and plot the OCC characteristics as shown . in graph 1

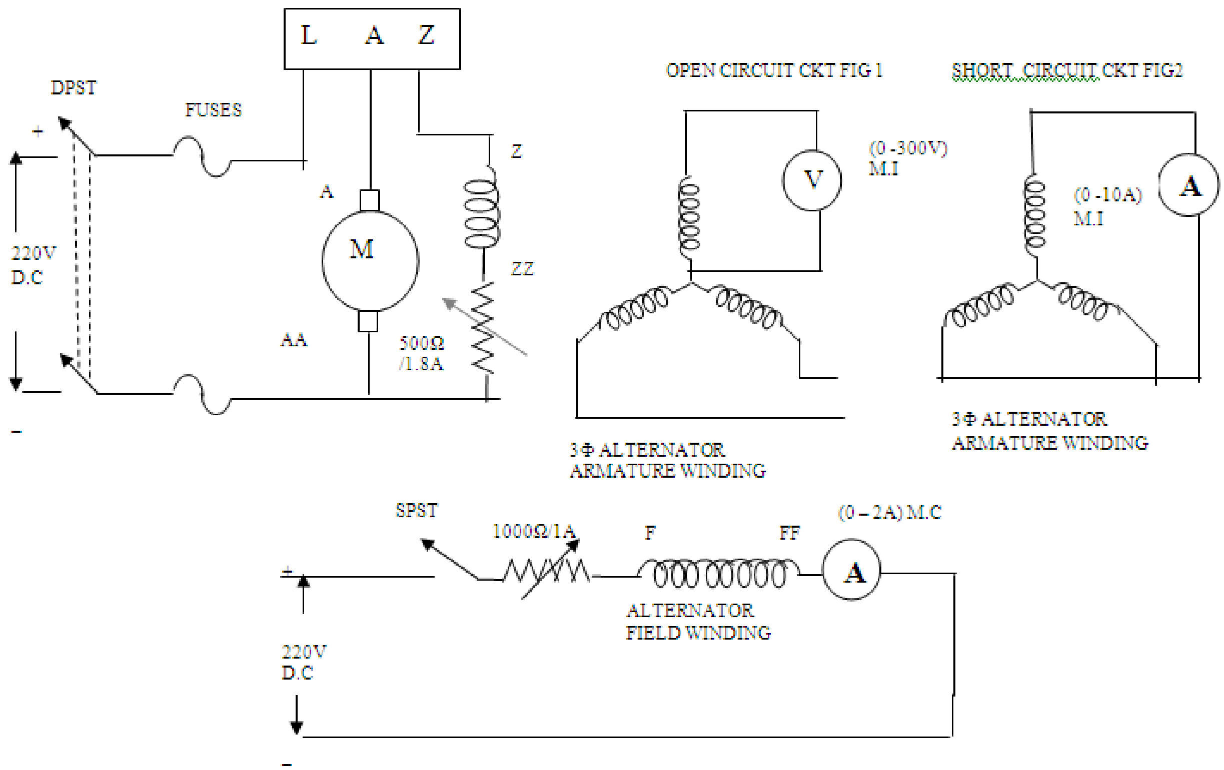
SHORT CIRCUIT TEST :

1. Keeping the previous connections unchanged replace voltmeter by ammeter and short the other two phases with neutral as shown in fig 2
2. Run the alternator set at rated speed and note down the excitation current with respect to short circuit current equal to full load current
3. Plot the curve field current Vs S.C current on the same graph drawn for OCC
4. Find synchronous impedance graphically from the above characteristics

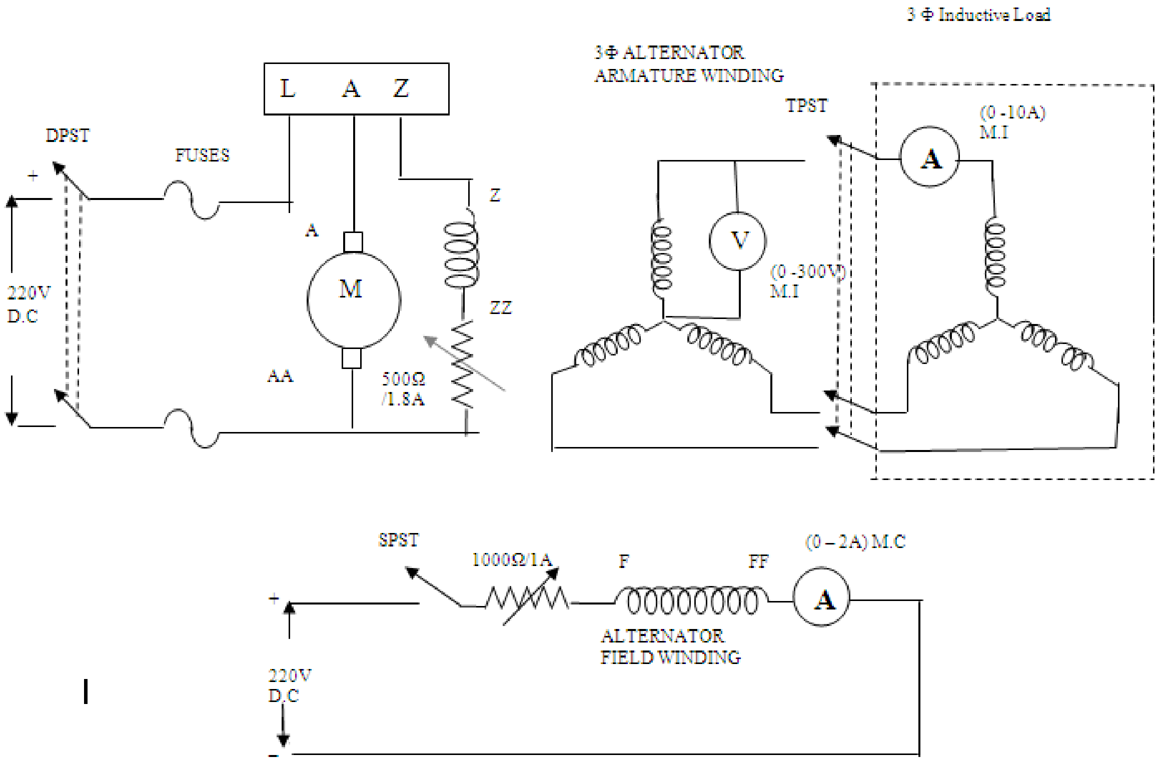
ZPF TEST:

1. Conduct a ZPF test by connecting the circuit as shown in fig 3
2. By adjusting the potential divider for full load current passing through either a inductive or capacitive load with zero power and note the field current and terminal voltage This gives one point on full load .

CIRCUIT DIAGRAM :



CIRCUIT DIAGRAM:



OBSERVATIONS :

OC TEST

Sno	If	Voc

SC TEST

Sno	If	Isc

ZPF TEST

Sno	If	Ia	V

GRAPHS:

Plot OCC between E_o & I_f

Plot SCC between Isc & I

Plot ZPF curve .

CALCULATIONS:

To calculate regn at 0.8 p.f lag & lead , UPF by synchronous impedance method

Synchronous Impedance $Z_s = E_1 / I_{sc}$

Where E 1 is the rated voltage & Isc is the S.ckt current at same value of field Current

a)Regulation at F.L at UPF

$$E_o = \sqrt{(V + I\,Ra)^2 + (I\,Xs)^2}$$

b) Regulation at F.L at 0.8 p.f lag

$$E_o = \sqrt{(V\cos\Phi + I\,Ra)^2 + (V\sin\Phi + I\,Xs)^2}$$

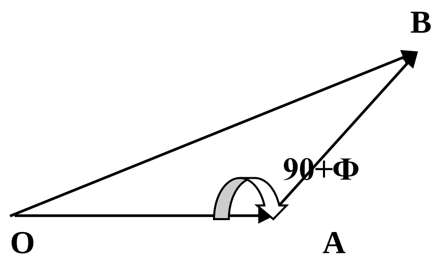
c) Regulation at F.L at 0.8 p.f lead

$$E_o = \sqrt{(V\cos\Phi + I\,Ra)^2 + (V\sin\Phi - I\,Xs)^2}$$

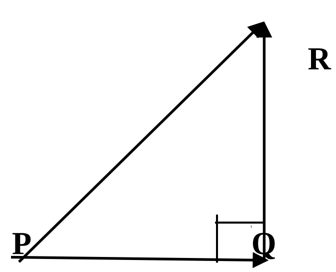
The full load voltage regulation of an alternator is defined as the percentage rise in terminal voltage when full load is thrown off i.e

$$\%\ regn = (E_o - V) / V \times 100$$

MMF Method :



Lagging P.F



UPF

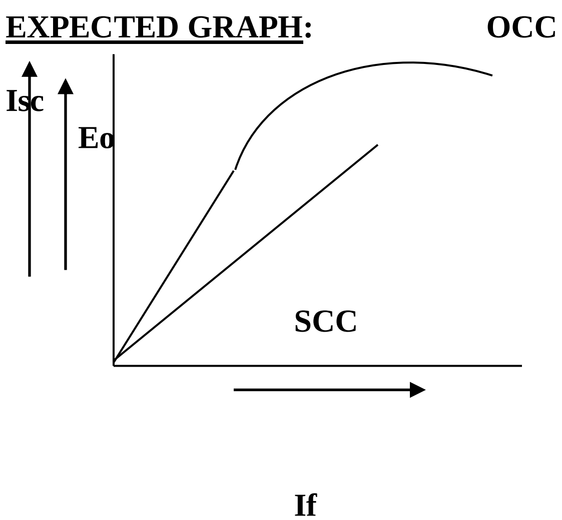
OA ,PQ – Field Current corresponding to rated voltage
AB ,QR – Field current corresponding to rated current
OB – Vector sum of OA & AB
PR _ Vector sum of PQ & QR

From the graph find the voltage corresponding to OB field current for lagging & PR for UPF
(E_0) and find regulation by using the below formula

For leading p.f replace + sign with – in lagging p.f

% regn = $(E_0 - V) / V * 100$

EXPECTED GRAPH:

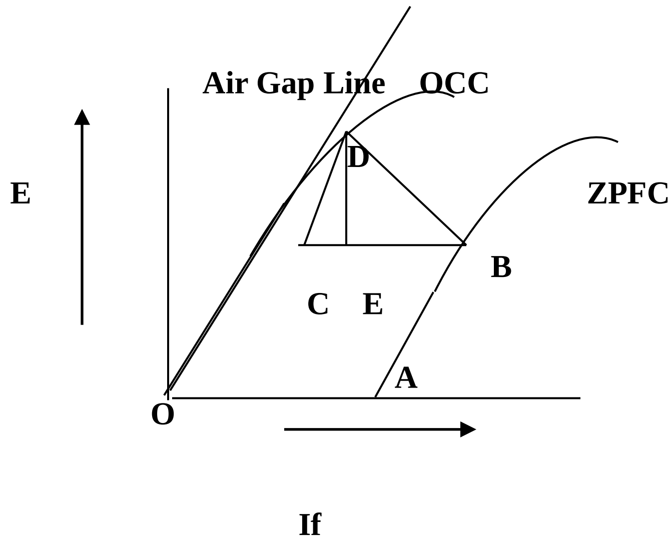


Procedure to draw potier triangle :

1. Draw open circuit characteristics (generated voltage Vs field current)
2. Mark point A at X axis which is obtained from short circuit test with full load armature current
3. From ZPF test ,mark the point B for field current to the corresponding rated voltage and rated armature current .
4. Draw ZPF curve which is passing through the point A & B in such a way parallel to OCC
5. Draw a tangent for OCC from origin (air gap line)
6. Draw the line BC parallel & equal to OA
7. Draw the parallel line to air gap line from C such that it cuts OCC at D .
8. Join the points B & D and drop perpendicular line DE to BC

The line DE represents armature leakage drop & BE represents armature reaction excitation

EXPECTED GRAPH:



Procedure to draw potier triangle vector diagram :

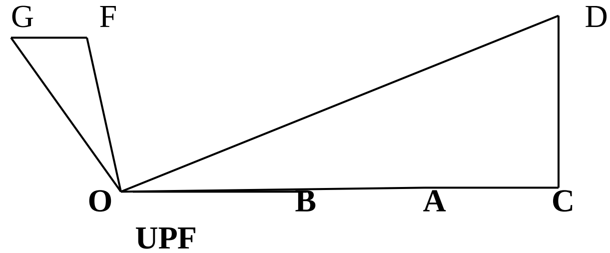
1. Select the suitable voltage & current scale
2. For the corresponding power factor angle (lag, lead or UPF) draw voltage vector OA and current vector OB
3. Draw the vector AC with magnitude of IRa drop which should be parallel to the vector OB
4. Draw perpendicular CD to AC from point C with magnitude of IX_L drop
5 Join the points O & D which will be equal to air gap voltage . (E ag)
6. Find out the field current corresponding to air gap voltage (E ag) from OCC
7. Draw the vector OF with magnitude of I ag which should be perpendicular to to the vector OD
8. Draw the vector FG from F with magnitude of Ifa in such a way that it is parallel to the current vector OB .
9. Join the points O & G which will be equal to the field excitation current (If r)
10 Find EMF (Eo) corresponding to Ifr and find the regulation using the below Formula

The full load voltage regulation of an alternator is defined as the percentage rise in terminal voltage when full load is thrown off i.e

% regn = (Eo – V) / V × 100

Where E_o = No Load voltage per phase
V = Full load voltage per phase

Vector Diagram:



Draw vector diagram for lagging & leading also

RESULTS:

SNO	Method Name	P.f	% regulation

DISCUSSION OF RESULTS

VIVA :

1. Mention any disadvantage of determining regulation by of an alternator by direct loading
2. Regulation of two alternators are 10% & 70% respectively .out of the above which one do you think is more suitable for supplying electricity to residential area? Give reasons to your answer .
3. State why regulation is negative for leading P.F. for an alternator ?
4. Mention why the speed of an alternator should remain constant at rated speed while performing open circuit test
5. Mention advantages & disadvantages of finding regulation by synchronous impedance & MMF method
6. What is the limitation of synchronous impedance method of determination of regulation ?
7. Compare the value of regulation obtained from MMF method to actual value of regulation of an alternator .

8. Is it necessary to draw complete ZPF load characteristics in order to determine potier reactance ?

9 Are the two characteristics of alternator Viz OCC and ZPF at full load similar in shape ?

10 Which method is more reliable for finding regulation What information can be obtained from potier triangle ?

11 What is the nature of load used to conduct the ZPF test on full load on an alternator for determining regulation

EXPT 7 : V & INVERTED V CURVES OF A SYNCHRONOUS MOTOR

AIM : To determine V & inverted V curves of a synchronous motor at no load & half load

NAME PLATE DETAILS:

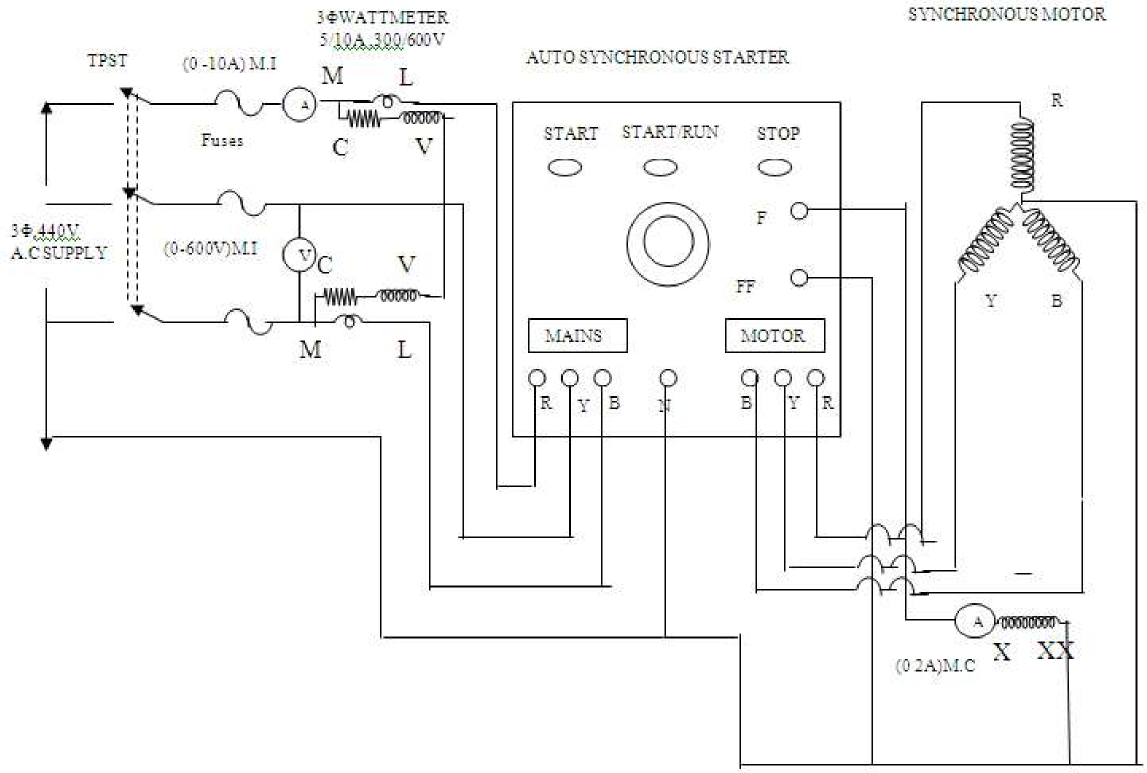
EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	RANGE	Type	QUANTITY
1	Voltmeter	0-600V	M.I	1
2	Ammeter	0-10A	M.I	1
3	3Φ Wattmeter	5/10A 300V/600V	M.I	1
4	Ammeter	0-2A	M.C	1
6	Tachometer			1
7	Connecting wires			1

PROCEDURE:

1. Make the connections as per circuit diagram .
2. Switch on the supply to the control panel and operate the push button ‘START’. Motor starts as an induction motor
3. When it has picked up maximum speed ,push the button ‘RUN’ .The machine pulls up & it runs as synchronous motor .
4. Observe the variation of line current with field current (field current can be varied by the rotary switch on the panel)
5. Note the readings of line current field current ,voltmeter & wattmeter at various steps of field at NO LOAD
6. Repeat step No 5 for ½ load by applying brake .
7. Take readings up to 120% of full load line current on either side

CIRCUIT DIAGRAM:



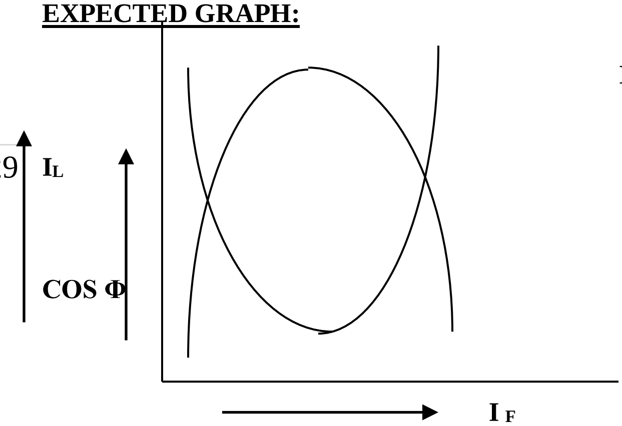
OBSERVATIONS:

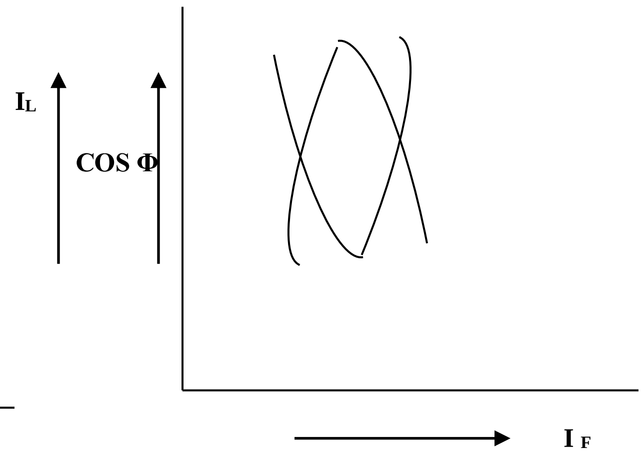
S. no	V (volts)	I_L (amp)	I_F (amp)	Input (W)	p.f
1					
2					
3					
4					

GRAPHS:

I. Line current Vs field current at no load & 1/2 load
II. Line current Vs p.f at no load & 1/2 load on the same graph

EXPECTED GRAPH:





RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA :

1. From the experiment results ,Suggest an application of a synchronous motor
2. Explain why p.f of a synchronous motor changes with change of excitation
3. Explain why the change of excitation of a synchronous motor the magnitude of armature current decreases and then increases
4. A slight decrease in field current worsens the operating P.F. Was P.F leading or Lagging ?
5. A synchronous motor is running at UPF at given excitation .What would be the P.F and armature if mechanical load is increased ?

EXPT 8 : P.F IMPROVEMENT OF 3 Φ INDUCTION MOTOR USING CAPACITORS

AIM : To study the effect of capacitors on the improvement of power factor of 3 Φ induction motor

NAME PLATE DETAILS:

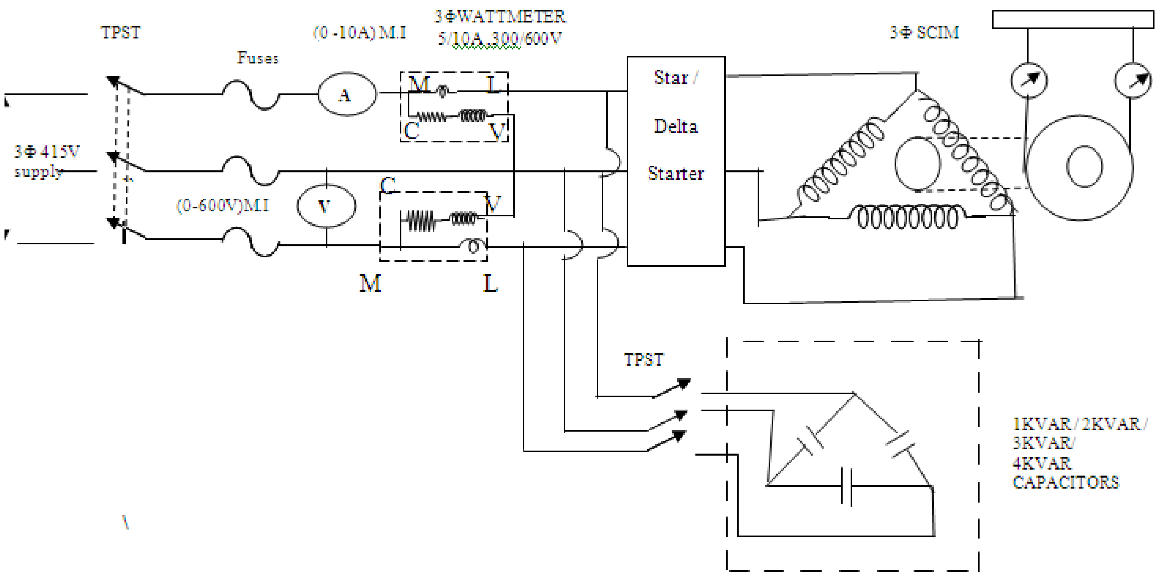
EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	RANGE	Type	QUANTITY
1	Voltmeter	0-600V	M.I	1
2	Ammeter	0-10A	M.I	1
3	3Φ Wattmeter	5/10A 300V/600V	M.I	1
4	Capacitors	1,2 ,3 ,4 Kvar		
5	Connecting wires			

PROCEDURE:

1. Make the connections as per circuit diagram .
2. Start the induction motor using Y/Δ starter
3. Take the readings the voltmeter ,Ammeter & wattmeter on No Load
4. Switch on the capacitors one by one and note down the values of voltmeter ,ammeter & wattmeter
5. Repeat the step 4 with 6 Amps load .

CIRCUIT DIAGRAM:



OBSERVATIONS:

NO LOAD

S. no	V (volts)	I (amp)	Input (W)	p.f	Remarks
1					
2					
3					
4					
5					

ON 6Amps LOAD

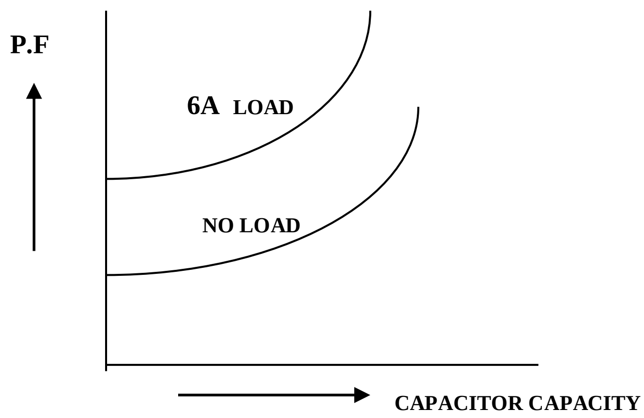
S. no	V (volts)	I (amp)	Input (W)	p.f	Remarks
1					
2					
3					
4					
5					

GRAPH:

Plot on the same graph

1. Capacitor capacity Vs P.F on No Load
2. Capacitor capacity Vs P.F at

EXPECTED GRAPH:



RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA:

1. What is the main reason behind the lower efficiency of I.M 's as compared to transformers ?
2. Why P.F of an I.M running on No Load is very low ?
3. Let a direct is passed through stator windings of 3Φ I.M .Calculate the speed of magnetic field .What will happen if motor is originally rotating?
4. Under which conditions a SCIM is preferred over Wound I.M?
5. What happens if any two phases of I.M are interchanged ?

EXPT9 : LOAD CHARACTERISTICS OF 3 Φ INDUCTION GENERATOR

AIM : To study the load characteristics of 3 Φ induction Generator

NAME PLATE DETAILS:

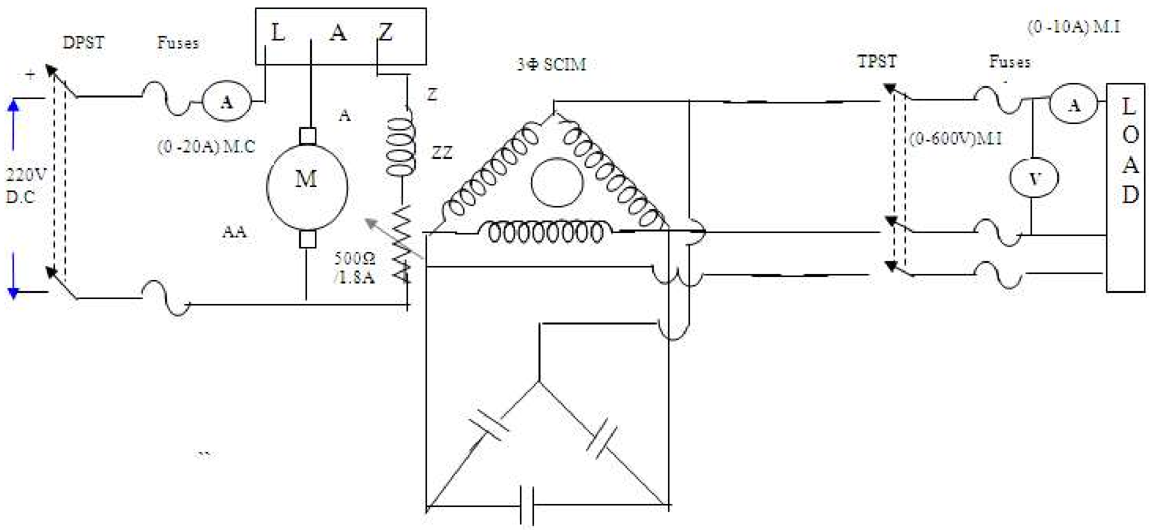
EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	RANGE	Type	QUANTITY
1	Voltmeter	0-600V	M.I	1
2	Ammeter	0-10A	M.I	1
3	3Φ Wattmeter	5/10A 300V/600V	M.I	1
4	Capacitors	1,2 ,3 ,4 Kvar		
5	Connecting wires			

PROCEDURE:

1. Make the connections as per circuit diagram .
2. Supply has given by closing the DPST switch .
3. Using the starter start the motor to run above synchronous speed by varying the motor field rheostat .
4. At No Load the Load current and voltage are noted .
5. By applying the load gradually note the values of various meters .
6. Later load is released and the motor is switched off .

CIRCUIT DIAGRAM:



4 KVAR CAPACITOR BANK

PRECAUTIONS :

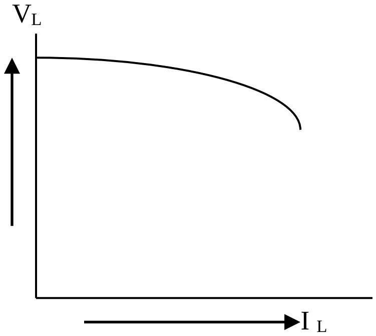
1. Initially all the switches should be open position .
2. The motor field rheostat should be kept in the minimum position .
3. Initially the capacitor bank should be charged

OBSERVATIONS:

Sno	Load current I_L (A)	Load Voltag V_L (V)

GRAPH: Plot the graph between load voltage & load current

EXPECTED GRAPH



RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA :

1. Give possible application for operating a SCIM in the generator mode .
2. How do you calculate the value of capacitance required for excitation of a induction generator ?

EXPT10 : RETARDATION TEST /DYNAMIC BRAKING OF DC SHUNT MOTOR

AIM : To Perform Retardation test (Running down) test on a D.C machine & determine the following

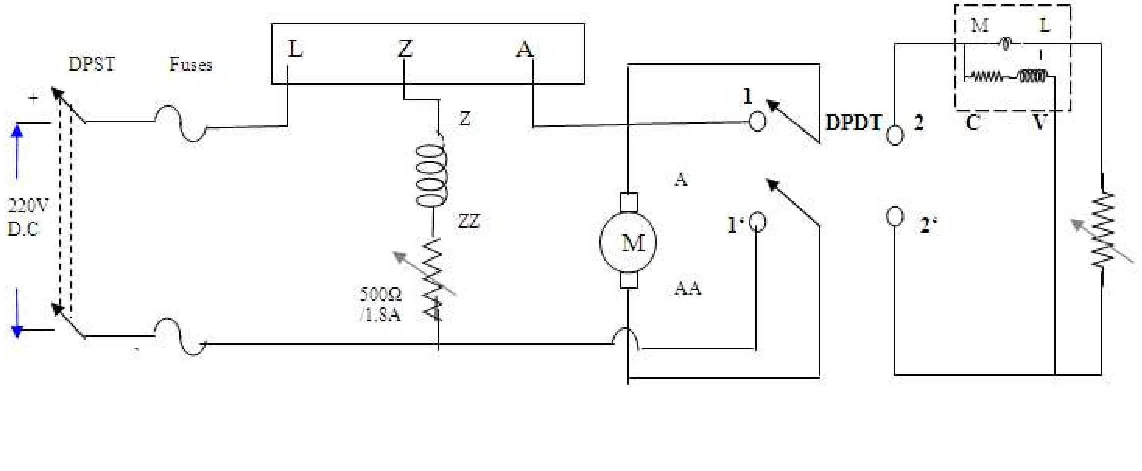
a) Rotational losses b) Moment of Inertia c) Magnetic losses

NAME PLATE DETAILS:

EQUIPMENTS REQUIRED:

SL.NO	EQUIPMENTS	RANGE	Type	QUANTITY
1	1Φ Wattmeter	5/10A 300V/600V UPF	Dynamometer	1
2	Rheostat	500Ω/1.8A	Wire Wound	1
3	Rheostat	100Ω	Wire Wound	
4	Connecting Wires			

CIRCUIT DIAGRAM:



PROCEDURE:

1 Make the connections as per circuit diagram .
2 Supply is given by closing the DPST switch & the DPDT switch is put on terminals 11' .& the machine is operated as normal shunt motor .The speed of the motor is adjusted by the field rheostat & is brought to above rated speed (say 1600rpm)
3 Experiment is done in three stages

STAGE 1 : In stage 1 the machine running above normal speed (1600rpm) supply is cut off by opening the DPST switch & time taken by the motor to fall from 1600rpm to 800 rpm is noted down by means of stop watch. Machine gradually slows down & Kinetic energy of rotating mass is spent in overcoming the friction & windage losses .

STAGE 2 : In stage 2 the machine is again adjusted to run above normal speed (say 1600rpm) & then the DPDT switch is open keeping in tact the supply & time taken by the motor to fall from 1600rpm to 800 rpm is noted down by means of stop watch. Machine slows down more rapidly & Kinetic energy of rotating mass is spent in overcoming the friction & windage losses & iron losses (stray losses)

STAGE 3 : In stage 3, Make sure to keep the armature rheostat in maximum position . The machine is adjusted to run above normal speed (1600rpm) & then the DPDT is thrown on position 22' & time taken by the motor to fall from 1600rpm to 800 rpm is noted down by means of stop watch. Machine slows down much more rapidly & Kinetic energy of rotating mass is spent in overcoming friction & windage losses & iron losses (stray losses) & armature copper losses of the load .In this case wattmeter reading is noted down at 1600rpm & 800 rpm

PRECAUTIONS :

1 Initially all the switches should be open position .
2 The motor field rheostat should be kept in the minimum position .
3 The armature rheostat should be kept in maximum position

OBSERVATIONS:

S No	Change in speed (dN)	Time taken (dt)	Wattmeter Reading
Stage 1			NIL
Stage 2			NIL
Stage 3			

CALCULATIONS:

K.E = ½ J w^2
Power = dE/dt = J w dw/dt
since w= 2ΠN/60 therefore Power = $(2\Pi/60)^2 \times J \times N \times dN/dt$

For stage 1 P1 = $(2\Pi/60)^2 \times J \times N \times dN/dt1$= Pmech ——— (1)

For Stage 2 P2=$(2\Pi/60)^2 \times J \times N \times dN/dt2$ = Ps ——— (2)

For stage 3 P3 = $(2\Pi/60)^2 \times J \times N \times dN/dt3$= Ps+ PL ——— (3)

where PL= average of wattmeter readings

Solving equation 1,2 & 3 will give Ps & Pmech .Further we can find Pi

By using any one above equation the moment of inertia can be found out

Further efficiency at any load can be predetermined

RESULTS:

DISCUSSIONS OF RESULTS (INFERENCE):

VIVA :

1. This method is suitable for large size D.C machines .Why ?
2. Can we separate the hysteresis & eddy current losses by this test ?
3. How retardation test better than Swinburne's test ?
4. How can you calculate the efficiency by this test ?