ELECTRICAL AND ELECTRONICS ENGINEERING LABORATROY MANUAL

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ELECTRICAL AND ELECTRONICS ENGINEERING LABARATORY

LIST OF EXPERIMENTS

VERIFICATION OF KVL AND KCL

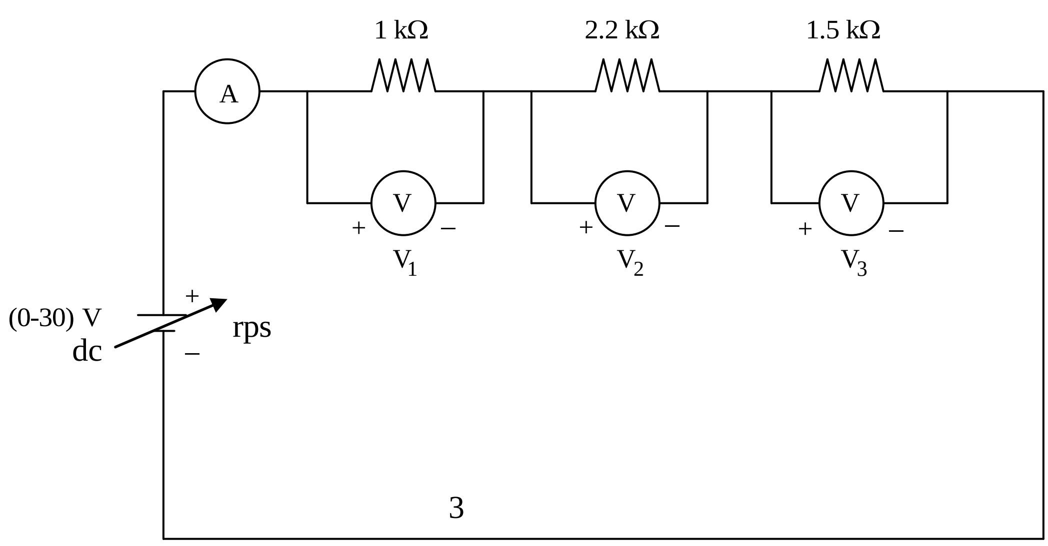
AIM: To verify Kirchhoff's Voltage and Current Law in a passive Resistive network

APPARATUS:

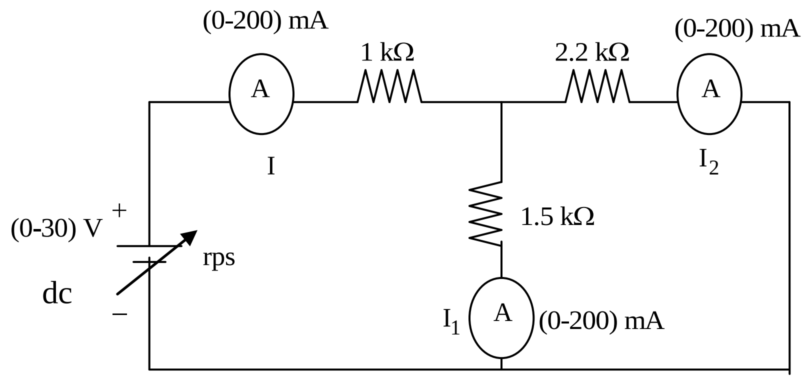
S.No	Components	Range	Type	Quantity
1.	RPS	(0-30) V	Digital	01
2.	Ammeter	(0-200) mA	Digital	03
3.	Voltmeter	(0-30) V	Digital	03
4.	Resistors	1 kΩ, 2.2 kΩ, 1.5 kΩ	-	01
5.	Connecting Wires	-	Single strand	As required
6.	Bread Board	-	WB102	01

CIRCUIT DIAGRAMS:

To Verify KVL



To Verify KCL



PROCEDURE:

1. To verify KVL:

- Connect the circuit diagram as shown in figure[1]
- Switch ON the supply to RPS.
- Apply the voltage (say 5v) and note the voltmeter readings
- gradually increase the supply voltage in steps
- note the readings of voltmeters
- sum up the voltmeter readings(voltage drops) , that should be equal to applied voltage(e.m.f)
- Thus KVL is Verified practically

2. To verify KCL:

- Connect the circuit diagram as shown in figure[2]
- Switch ON the supply to RPS.
- Apply the voltage (say 5v) and note the Ammeter readings
- gradually increase the supply voltage in steps
- note the readings of Ammeters
- sum up the Ammeter readings(I_1 and I_2) , that should be equal to total current(I)
- Thus KCL is Verified practically

TABULAR COLUMN: 1

S. No.	Applied Voltage (Volts)	Volt Meter Readings			
		V_1 (Volts)	V_2 (Volts)	V_3 (Volts)	$V_1 + V_2 + V_3$ (Volts)
1.					
2.					
3.					
4.					
5.					

TABULAR COLUMN: 2

S. No.	Applied Voltage (V)	Ammeter Readings			
		I (Amps)	I_1 (Amps)	I_2 (Amps)	I_1+I_2 (Amps)
1.					
2.					
3.					
4.					
5.					

PRECAUTIONS:

1. Check for proper connections before switching the supply ON
2. make sure of proper color coding of resistors
3. Avoid parallax errors in measuring instruments.

RESULT:

At 15V supply	Theoretical value	Practical value
$V_1 + V_2 + V_3$		
I_1+I_2		

MAGNETIZATION CHARACTERISTIC OF A D.C. SHUNT GENERATOR

AIM:

To determine experimentally the magnetization or open circuit characteristic of a D.C Shunt generator and to determine the critical field resistance and critical speed.

APPARATUS:

S.No.	Item	Type	Range	Quantity
1	Ammeter	(M.C)	0 – 2 A	1 No
2	Voltmeter	(M.C)	0 – 300 Volts	1 No
3	Rheostat	Wire wound	370 ohms / 1.7 A	2 No
4	Tachometer	Digital	0-3000 rpm	1 No

NAME PLATE DETAILS:

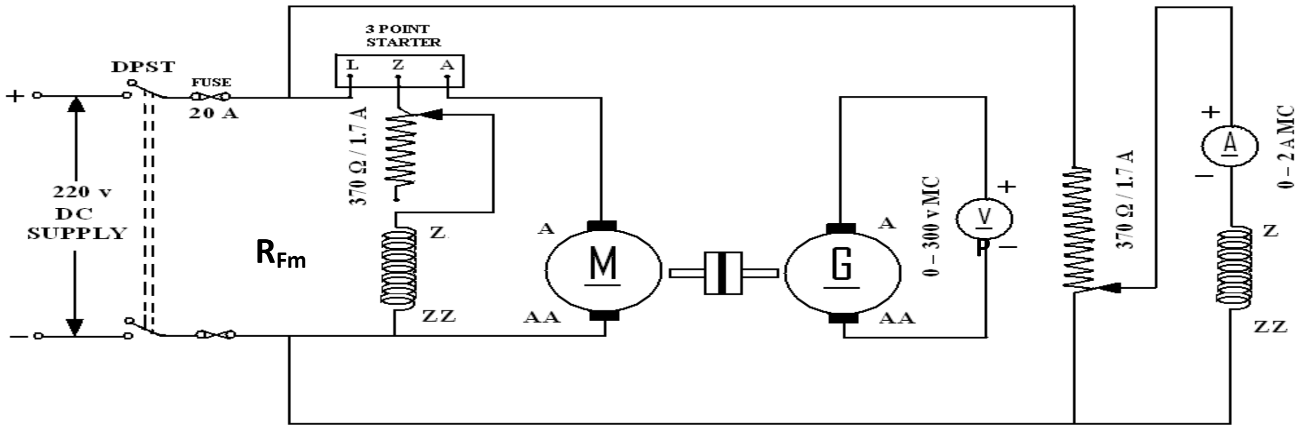
MOTOR

Voltage	
Current	
Output	
Speed	

GENERATOR

Voltage	
Current	
Output	
Speed	

CIRCUIT DIAGRAM:



OPEN CIRCUIT CHARACTERISTICS OF
DC SHUNT GENERATOR

PROCEDURE:

1. Choose the proper ranges of meters after noting the name plate details of the given machine and make the connections as per the circuit diagram.
2. **Keep the motor field rheostat (R_{fm}) in the minimum position**. The jockey [J] of the potential divider should be at the minimum voltage position [P] and start the MG set.
3. Observe the speed of the generator using a tachometer and adjust to the rated value by varying the motor field rheostat. Keep the same speed through out the experiment.
4. Note down the terminal voltage of the generator. This is the e.m.f. due to residual magnetism.
5. Increase the generator field current I_f (ammeter) by gradually moving the jockey J in the direction P to Q. for every value of If, field resistance of the generator note down the corresponding voltmeter reading. Increase the field current till induced e.m.f is about 120% of rated value.
6. Repeat the same procedure for decreasing values of the same field currents (I_{fg}) and finally note down the emf generated due to residual magnetism.

7. Draw the characteristics of generated emf (E_{fg}) versus field current for both increasing and decreasing values of field current. Draw the average O.C.C
8. Draw a tangent to the initial portion of average O.C.C from the origin. The slope of this straight line gives the critical field resistance.

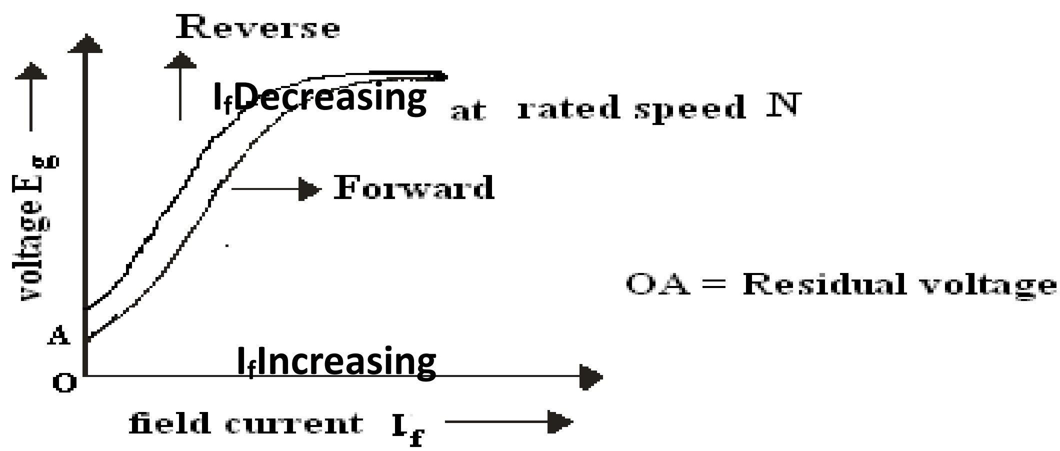
TABULAR COLUMN:

S.No.	ASCENDING		DESCENDING	
	Field current (amp)	Generated voltage (volts)	Field current (amp)	Generated voltage (volts)

PRECAUTIONS:-

1. The experiment should be done at constant speed.
2. The jockey should be moved only in one direction (i.e., from P to Q or Q to P). It should not be moved back and forth for obtaining a particular field current.
3. At zero field there would be some emf due to residual magnetism
4. Avoid parallax errors and loose connections

MODEL GRAGH:



VIVA Questions:

1. Under what conditions does the DC shunt generator fail to self-excite?
2. Define critical field resistance?
3. OCC is also known as magnetization characteristic, why?
4. How do you get the maximum voltage to which the generator builds up from OCC?
5. What does the flat portion of OCC indicate?
6. Why OCC does not start from origin?
7. Does the OCC change with speed?

RESULT:

SWINBURNE'S TEST ON A D.C. SHUNT MACHINE

AIM:

To pre-determine the efficiency of a DC shunt machine when run both as generator and motor.

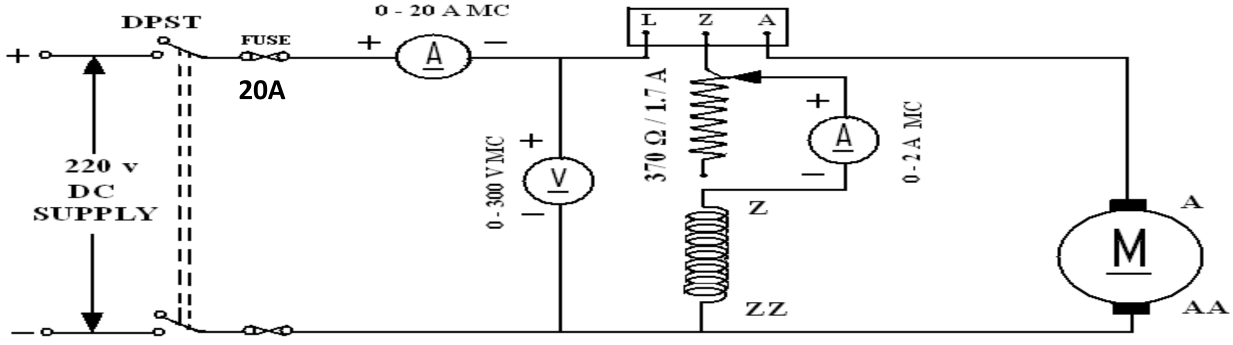
APPARATUS REQUIRED:

S. No.	Name of the Equipment	Range	Type	Quantity
1.	Voltmeter		M.C	01
			M.C	01
2.	Ammeter	0-15A	M.C	01
3.	Rheostat		-	01
			-	01
4.	Tachometer	-	DIGITAL	01

Motor

Voltage		**Output**	
Current		**Speed**	

CIRCUIT DIAGRAM:



SWINBURNE'S TEST ON DC SHUNT MOTOR

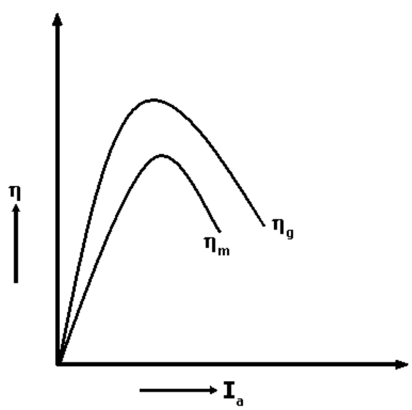
PROCEDURE:

1. Choose the proper ranges of meters after noting the name plate details of the given machine and make the connections as per the circuit diagram.
2. Keep the motor field rheostat (R_{fm}) in the minimum position, Start the motor by closing the switch and operating the starter slowly.
3. Run the motor at rated speed by adjusting the motor field rheostat.
4. Note down the voltage, no load current and field current.

TABULAR COLUMN:

S. No.	V	I_{Lo}	I_f

Model Graph:



CALCULATIONS FOR SWINBURNE'S TEST

From the no load test results,

Supply voltage = V_L Volts.

No load line current = I_{Lo}Amperes.

Field current= I_f Amperes.

Therefore No load Armature Current = I_{ao} = I_L-I_f Amperes.

Resistance cold = R_m

Effective resistance R_e = 1.25 x R_m ohms.

No load copper losses are =I_{ao}^2 R_e

No load power input=$V_L I_L$

Constant losses = (No load power input - No load copper losses). ------------ (1)

Efficiency as motor:

Efficiency=output/input = (input – total losses)/ input.

Where total losses = constant losses + variable losses.

Constant losses are known value from the equation (1)

Variable loss = I_a^2 R_e , where I_a= I_L-I_f

Input = V_L $I_{L..}$$V_L$ is rated voltage of the machine

Assume line currents (I_L) as 2, 4,6,----20A and find corresponding efficiency

Efficiency as generator:

Efficiency=output/input = output / (output + total losses).

Where losses = constant losses + variable losses

Constant losses are same for both motor and Generator

Armature Current = $I_a = I_L + I_F$

Variable loss = $I_a^2 R_e$

Output power = $V_L I_L$. V_L is rated voltage of the machine

Assume load currents (I_L) as 2, 4,6,----20A and find corresponding efficiencies

TABULAR COLUMN:

As a Motor: **Rated voltage V_L =** **Rated speed N =**

S. No.	I_L	$V_L I_L$ INPUT Power	Constant losses $W_{const.}$	Copper losses $W_{cu} = I_a^2 R_e$	Total losses = ($W_{cons.}$ + W_{cu})	Output power = (input power – losses)	η

As a Generator: **Rated voltage V_L =** **Rated speed N =**

S.	I_L	$V_L I_L$ Out	Constant losses $W_{const.}$	Copper losses $W_{cu} = I_a^2 R_e$	Total loss = ($W_{cons.}$ +	Input power = (output power +	η

No.		power			W_{cu})	losses)	

PRECAUTIONS:

- Run the motor at rated speed and rated voltage
- Avoid loose connections and parallax errors

RESULTS:

VIVA Questions:

1. Will the values deduced from the Swinburne's method exactly coincide with the value realized by direct loading on the machine? Why?
2. Why are the constant losses calculated by this method less than the actual losses?
3. Can we conduct Swinburne's test on dc series motor?
4. What are the drawbacks of Swinburne's test?

BRAKE TEST ON DC SHUNT MOTOR

AIM:

To obtain the performance characteristics of DC shunt motor by direct loading.

APPARATUS REQUIRED:

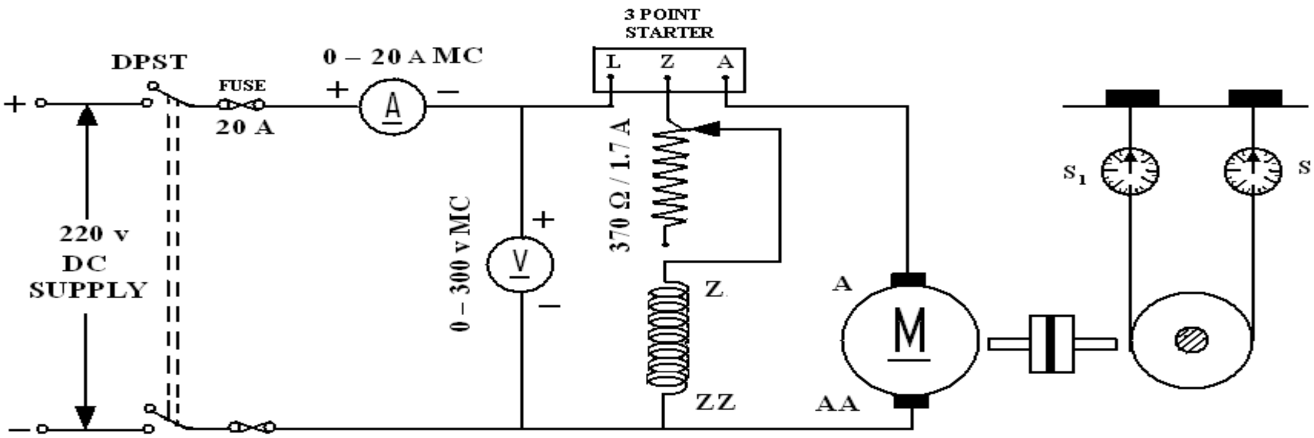
S. No.	Name of the Equipment	Range	Type	Quantity
1.	Voltmeter	0-300V	M.C	01
2.	Ammeter	0-2A	M.C	01
3.	Rheostat	0-370 Ohms/1.7A	-	01
4.	Tachometer	-	Digital	01
5.	Connecting wires	-	-	As per required

NAME PLATE DETAILS:

Motor

Voltage	
Current	
Output	
Speed	

CIRCUIT DIAGRAM:



BRAKE TEST ON DC SHUNT MOTOR

PROCEDURE:

1. Make the connections as shown in the circuit diagram.
2. Keeping the field rheostat (R_f) at the minimum position, switch on the supply and start the motor.
3. Adjust the speed of the motor on no load to its rated value by means of the field rheostat. DO NOT DISTRUB THE POSITION OF THE RHEOSTAT THROUGH OUT THE TEST.
4. Put on the load by tightening the screws of the spring balances. Note down the spring tensions, the speed, the voltage and the currents at different loads until full load current obtained.

CALCULATIONS:

1. Measure the circumference of the brake drum and calculate its radius (r), in meters.
2. Calculate the torque, T = Wrg (N.m). Where $W = W_1 - W_2$ = spring balance reading (the difference between the spring tensions) and ‘g’ is acceleration due to gravity i.e.9.81. Calculate the power output of the motor given by $P_0 = 2\Pi NT/60$
3. Calculate the input power, $P_I = VI_L$(I_L is the line current = $I_a + I_f$).

4. Calculate the percentage efficiency, $\eta = P_0/P_I x\ 100$

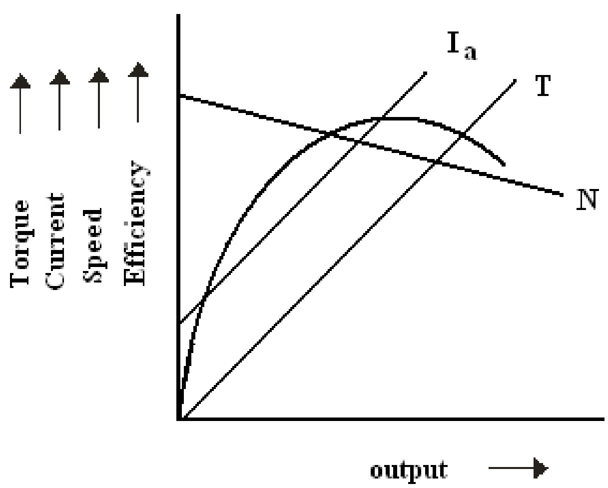
TABULAR COLUMN

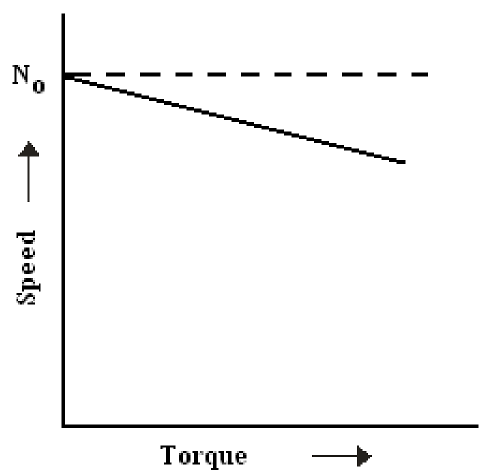
For Load Test:

Radius of Brake Drum:

S.No.	V_L (V)	I_L (A)	Speed (r.p.m.)	Spring Balance readings (Kgs)			Torque (N-m)	I.P (KW)	O.P (KW)	η 0.P / I.P (%)
				S_1	S_2	$S_1 \sim S_2$				

Model graphs:





RESULT:

VIVA Questions:

1. Why did you use a 3-point starter for starting a D.C shunt motor?
2. If starter is not available, how can you start a D.C motor?
3. What is the efficiency range of a D.C motor?
4. Where can you use the D.C shunt motor?
5. Why is it considered as a constant speed motor?

OPEN CIRCUIT & SHORT CIRCUIT TEST ON A SINGLE PHASE TRANSFORMER

AIM:

To perform open circuit and short circuit test on a single phase transformer and to pre-determine the efficiency, regulation and equivalent circuit of the transformer.

APPARATUS REQUIRED:

Sl. No.	**equipment**	**Type**	**Range**	**Quantity**
1	Voltmeter	MI	(0-300)V (0-30)V	1 no 1 no
2	Ammeter	MI	(0-1)A (0-10)A	1 no 1 no
3	Wattmeter	Dynamo type	(0-300)V LPF (0-2.5)A	1 no
4	Wattmeter	Dynamo type	(0-150)V UPF (0-10)A	1 no
5	Connecting Wires	*****	*****	Required

Transformer Specifications:

Transformer Rating :(in KVA) __________

Winding Details:

LV (in Volts): __________________________

LV side current:________________________

HV (in Volts): _________________________

HV side Current:_____________________

Type (Shell/Core):____________________

Auto transformer Specifications:

Input Voltage (in Volts):_______________

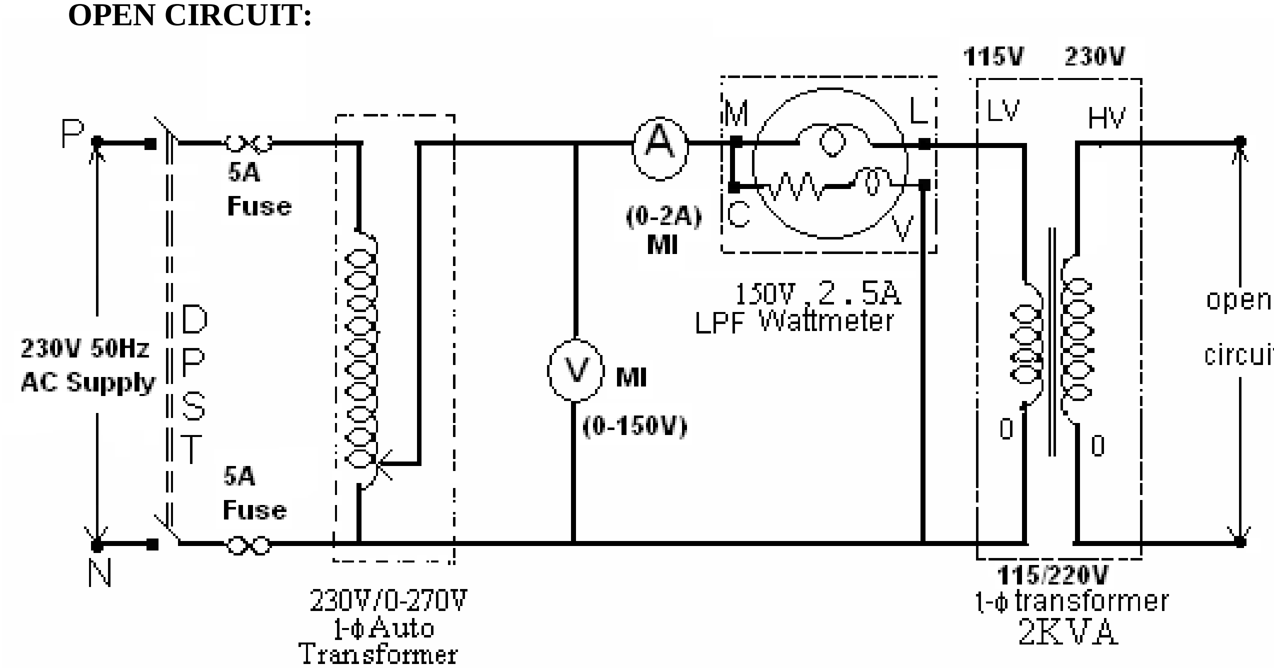
Output Voltage (in Volts): _____________

frequency (in Hz):_____________________

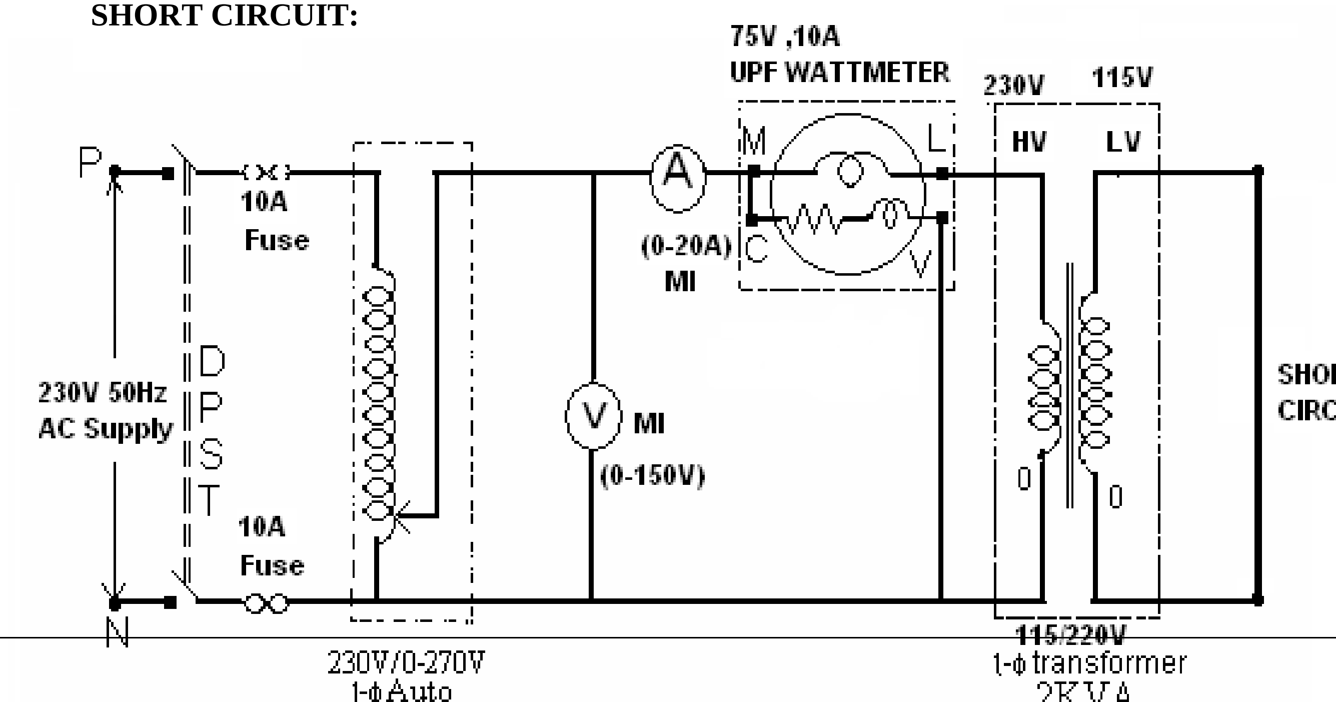
Current rating (in Amp):______________

CIRCUIT DIAGRAM:

OPEN CIRCUIT:



SHORT CIRCUIT:



PROCEDURE:

Open circuit test:

1. Connections are made as per the circuit diagram.
2. Ensure that variac is set to zero output voltage position before starting the experiment.
3. Switch ON the supply. Now apply the rated voltage to the Primary winding by using Variac.
4. The readings of the Voltmeter, ammeter and wattmeter are noted down in Tabular form.
5. Then Variac is set to zero output position and switch OFF the supply.
6. Calculate $\mathbf{R_o}$ and $\mathbf{X_o}$ from the readings.

Short Circuit Test:

1. Connections are made as per the circuit diagram.
2. Ensure that variac is set to zero output voltage position before starting the experiment.
3. Switch ON the supply. Now apply the rated Current to the Primary winding by using Variac.
4. The readings of the Voltmeter, ammeter and wattmeter are noted down in Tabular form.
5. Then Variac is set to zero output position and switch OFF the supply.
6. Calculate $\mathbf{R_{o1}}$ and $\mathbf{X_{o1}}$ from the readings.

OBSERVATIONS:

1) For OC test

Sl no.	Voltmeter reading (V_o)	Ammeter reading (I_o)	Wattmeter reading W_o	R_o	X_o	Cos ϕ_o

II) For SC test

Sl no.	Voltmeter reading (V_{SC})	Ammeter reading (I_{SC})	Wattmeter reading W_{SC}	R_{o1}	Z_{o1}	X_{o1}

MODEL CALCULATIONS:

Find the equivalent circuit parameters R_0, X_0, R_{01}, R_{02}, X_{01} and X_{02} from the O. C. and S. C. test results and draw the equivalent circuit referred to L. V. side as well as H. V. side.

Let the transformer be the step-down transformer

Primary is H. V. side.

Secondary is L. V. side

$R_0 = \frac{V_1}{I_w}$ where $I_w = I_0 \cos\phi_0$

$X_0 = \frac{V_1}{I_m}$ Where $I_m = I_0 \sin\phi_0$

$R_{0_1} = \frac{W_{SC}}{I_{sc}^2}$, $Z_{01} = \frac{V_{SC}}{I_{SC}}$

$X_{0_1} = \sqrt{Z_{01}^2 - R_{01}^2}$ **:** $X_{02} = K^2 X_{01}$ Where K = $\frac{V_2}{V_1}$ = Transformation ratio.

Calculations to find efficiency and regulation

For example at ½ full load

Cupper losses = W_{sc} x $(1/2)^2$ watts, where W_{SC} = full – load cupper losses

Constant losses = W_0 watts

Output = ½ KVA x cos ϕ [cos ϕ may be assumed]

Input = output + Cu. Loss + constant loss

$$\%\ efficiency = \frac{Output}{Input}\ x\ 100$$

Efficiency at different loads and P.f's

cos ϕ = ____________

Regulation: From open circuit and Short circuit test

$$\%\ Regulation = \frac{I_2 R_{02} \cos\phi \pm I_2 X_{02} \sin\phi}{V_2}\ x\ 100$$

'+' for lagging power factors

'-' for leading power factor

S.No	**p.f.**	**% reg**	
		Lag	**Lead**

Cosϕ = 1.0

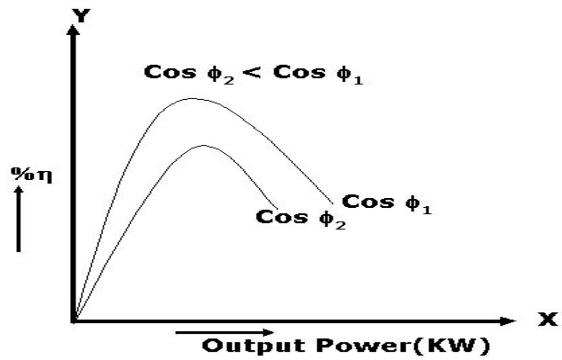
S.No	Load	Wcu (W)	O/P (W)	I/P (W)	η (%)

Cosϕ = 0.8

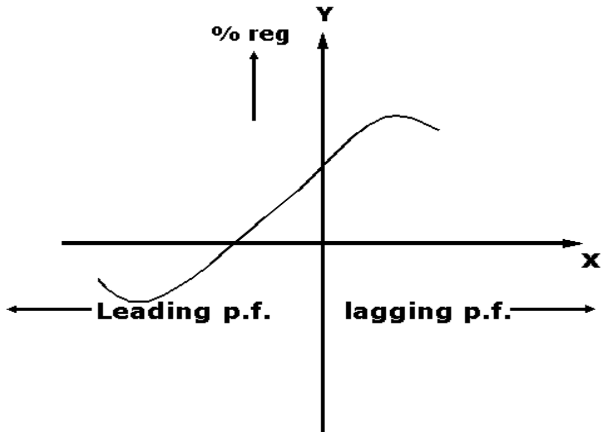
S.No	Load	Wcu (W)	O/P (W)	I/P (W)	η (%)

GRAPHS: Plots drawn between

(i) % efficiency Vs output



(ii) % Regulation Vs Power factor



PRECAUTIONS:

(i) Connections must be made tight

(ii) Before making or breaking the circuit, supply must be switched off

RESULT:

BRAKE TEST ON 3- ϕ SQUIRREL CAGE INDUCTION MOTOR

AIM:

To determine the efficiency of 3- ϕ induction motor by performing load test. To obtain the performance curves for the same.

APPARATUS REQUIRED:

Sl. No.	Equipment	Type	Range	Quantity
1	Voltmeter	MI	(0-600)V	1 no
2	Ammeter	MI	(0-10)A	1 no
3	Wattmeter	Electro dynamo meter type	10A/600V UPF 10A/600V LPF	1 no 1 no
4	Tachometer	Digital	*****	1 no
5	Connecting Wires	*****	*****	Required

NAME PLATE DETAILS:

Power rating	
Voltage	
Current	
Speed(RPM)	

Frequency	
PF	

3- ϕ Auto transformer Details:

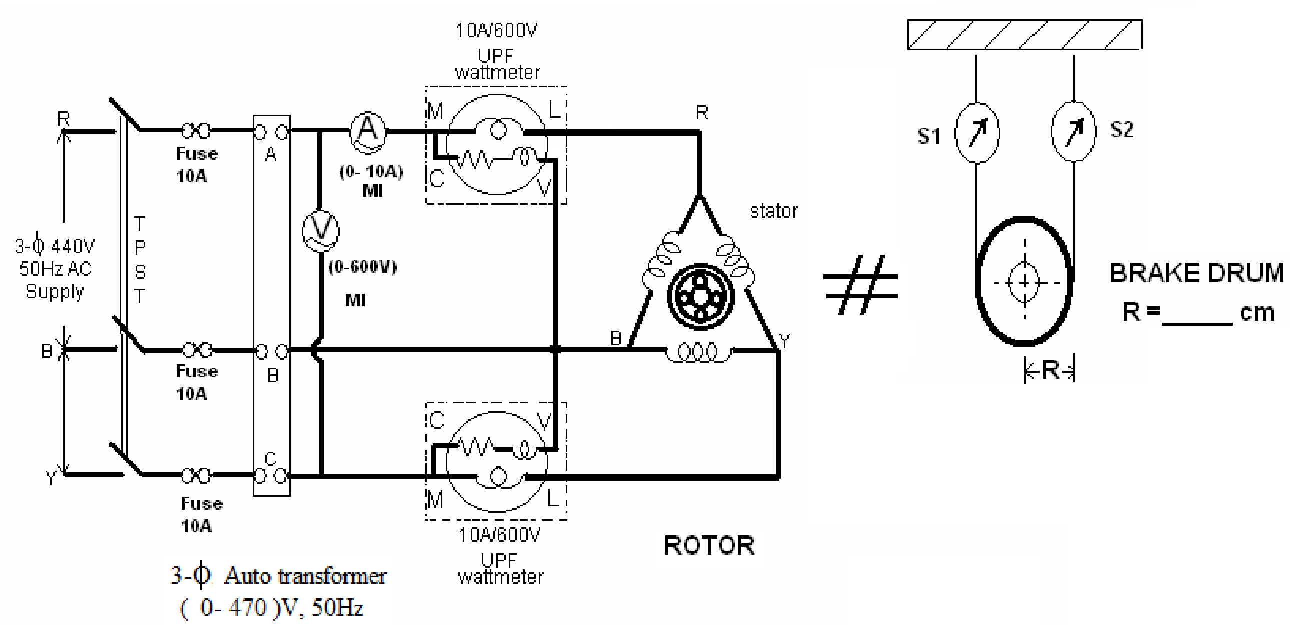
Input Voltage: __________________ (Volt)

OutputVoltage:__________________(Volt)

Current:_______________________(Amp.)

Freq.:___________________________(Hz)

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.

2. Ensure that the 3- ϕ variac is kept at minimum output voltage position and belt is freely suspended.

3. Switch ON the supply. Increase the variac output voltage gradually until rated voltage is observed in voltmeter. Note that the induction motor takes large current initially, so, keep an eye on the ammeter such that the starting current current should not exceed 7 Amp.

4. By the time speed gains rated value, note down the readings of voltmeter, ammeter, and wattmeter at no-load.

5. Now the increase the mechanical load by tightening the belt around the brake drum gradually in steps.

6. Note down the various meters readings at different values of load till the ammeter shows the rated current.

7. Reduce the load on the motor finally, and switch OFF the supply.

MODEL CALCULATIONS:

Input power drawn by the motor $W = (W_1 \pm W_2)$ watts

Shaft Torque, $T_{sh} = 9.81\,(S_1 \sim S_2)\,R$ N-m R → Radius of drum in mts.

Output power in watts = $\dfrac{2\pi N T_{sh}}{60}$ *watts*

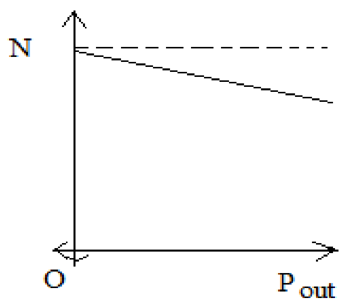
$$\%\ efficiency = \frac{output\ \ power\ \ in\ \ watts}{Input\ \ power\ \ in\ \ watts}\ x\ 100$$

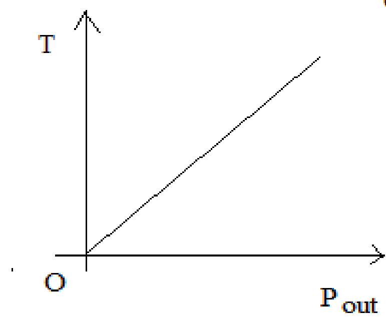
$$\%\ slip = \frac{N_s - N}{N_s}\ x\ 100 \qquad \left[where\ N_s = \frac{120\ x\ f}{p} \right]$$

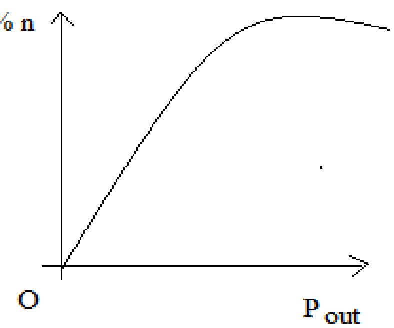
power factor of the induction motor $\cos\phi = \dfrac{W}{\sqrt{3}\, V_L\ I_L}$

MODEL GRAPHS:

1. Speed or slip Vs output power
2. Torque Vs output power
3. % efficiency Vs output power







OBSERVATIONS:

S. No.	V (Volts)	I (Amps)	Power, W (Watts)		Speed (RPM)	Torque (N-m)	Spring balance (Kg)		% Slip	Cos Ø	Output Power (W)	%η
			W_1	W_2			S_1	S_2				

VIVA Questions:

1. Why starter is used? What are different types of starters?
2. Compare a slip ring induction motor with cage induction motor?
3. Why the starting torque is zero for a Single Phase induction motor and non-zero of 3phase induction motor?
4. What are the disadvantages of this method?
5. Can we use rotor resistance method for starting?

PRECAUTIONS:

1. Connections must be made tight
2. Before making or breaking the circuit, supply must be switched off

RESULT

REGULATION OF ALTERNATOR USING SYNCHRONOUS IMPEDANCE METHOD

AIM:

To find the regulation of a 3 - ϕ alternator by using synchronous impedance method.

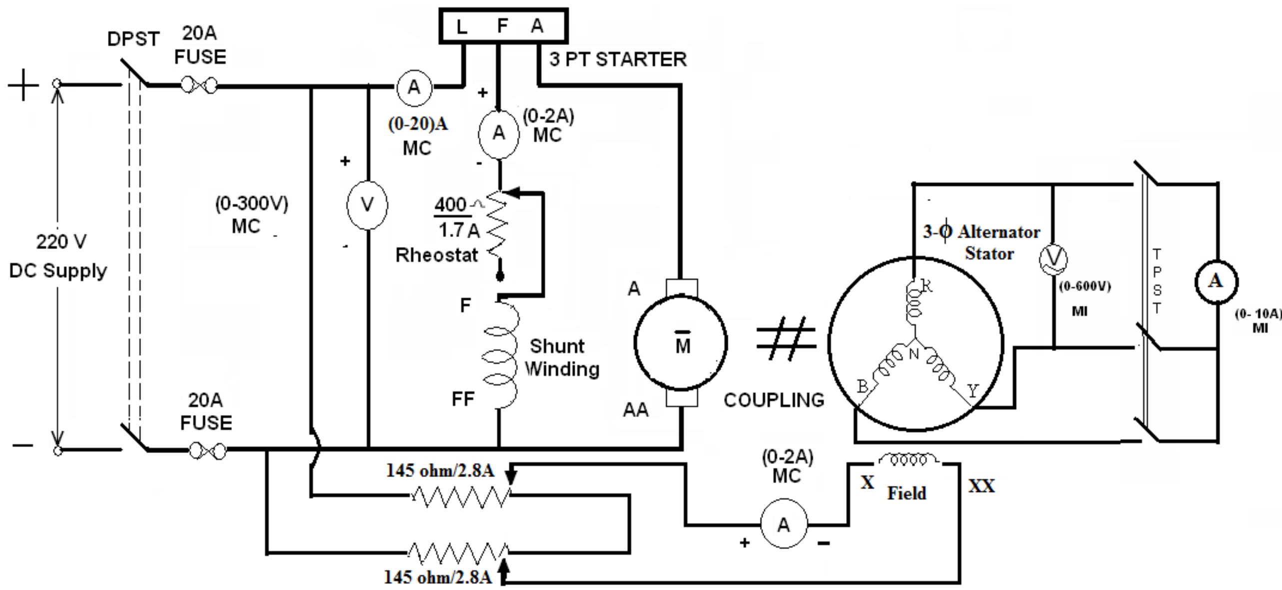
APPARATUS REQUIRED:

Sl. No.	Equipment	Type	Range	Quantity
1	Voltmeter	MI	(0-300/600)V	1 no
2	Ammeter	MI	(0-5/10)A	1 no
3	Ammeter	MI	(0-2.5/5)A	1 no
3	Rheostat	Wire-wound	400 Ω /1.7A 145Ω /2A	1 no 2 no
4	Tachometer	Digital	*****	1 no
5	Connecting Wires	*****	*****	Required

NAME PLATE DETAILS:

DC Motor(prime mover)	**3- ϕ Alternator**
KW :	Power Rating:
Voltage :	PF :
Current :	Line voltage:
Speed :	Speed
Exctn : Shunt	Exctn Voltage:
Voltage :	Rated Current :
Field current::	

CIRCUIT DIAGRAM:



PROCEDURE:

Open Circuit Test:

1. Make the connections as per the circuit diagram.
2. Before starting the experiment, the potential divider network in the alternator field circuit and field regulator rheostat of motor circuit is set minimum resistance position.
3. Switch ON the supply and close the DPST switch. The DC motor is started by moving starter handle.
4. Adjust the field rheostat of DC motor to attain rated speed (equal to synchronous speed of alternator)
5. By decreasing the field resistance of Alternator, the excitation current of alternator is increased gradually in steps.
6. Note the readings of field current, and its corresponding armature voltage in a tabular column.
7. The voltage readings are taken upto and 10% beyond the rated voltage of the machine.

Short Circuit Test:

1. For Short circuit test, before starting the experiment the potential divider is brought back to zero output position, i.e., resistance should be zero in value.
2. Now close the TPST switch.
3. The excitation of alternator is gradually increased in steps until rated current flows in the machine and note down the readings of excitation current and load current (short circuit current)
4. Switch OFF the supply.

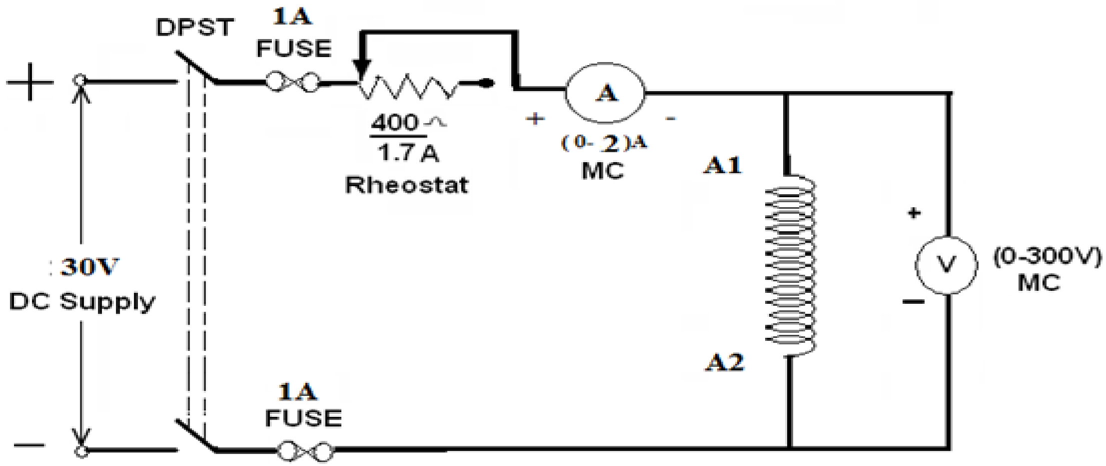
OBSERVATIONS:

Sl no.	OC test		Sl no.	S.C. test	
	Field current in Amp.(I f)	OC voltage per phase (Vo)		Field current I_f(Amp.)	SC current I_{sc} Amp.

Procedure to find Armature resistance of alternator:

1. Connections are made as per the circuit diagram.
2. Switch ON the supply. By varying the rheostat, take different readings of ammeter and voltmeter in a tabular column.
3. From the above readings, average resistance Ra of a armature is found out.

Connection diagram to find Ra



OBSERVATIONS:

Sl no.	Armature current I(amp)	Armature voltage Va (volts)	R_{dc}=V / I

Procedure to find synchronous impedance from OC and SC tests:

1. Plot open circuit voltage, short circuit current verses field current on a graph sheet.
2. From the graph, the synchronous impedance for the rated value of excitation is calculated.
3. The excitation emf is calculated at full load current which is equal to the terminal voltage at No load.
4. The voltage regulation is calculated at rated terminal voltage.

MODEL CALCULATIONS:

$Z_S = \frac{V_{OC}}{I_{SC}}$ for the same I_f and speed: $X_S = \sqrt{Z_S^2 - R_a^2}$ [∵ R_a R_{dC}]

Generated emf of alternator on no load is

$$E_0 = \sqrt{(v\cos\phi + I_a R_a)^2 + (v\sin\phi \pm I_a X_S)^2}$$

+ for lagging p.f.

- for leading p.f.

The percentage regulation of alternator for a given p.f. is

$$\% \operatorname{Re} g = \frac{E_0 - V}{V} \, x\, 100$$

Where

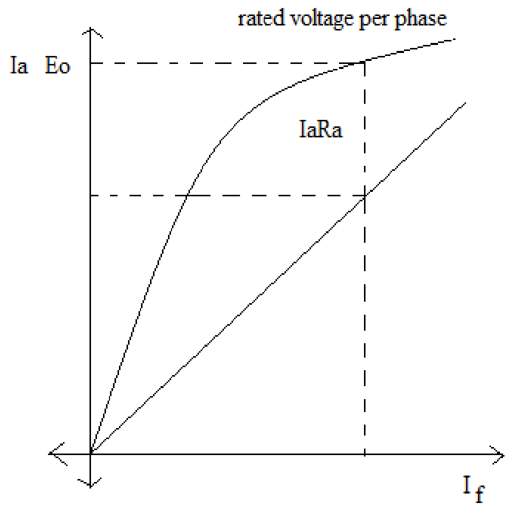
E_0 – generated emf of alternator (or excitation voltage per phase)

V – full load, rated terminal voltage per phase.

MODEL GRAPHS:

Draw the graph between I_f V_S E_0 per phase

and I_f V_S I_{SC}



PRECAUTIONS:

(iii) Connections must be made tight

(iv) Before making or breaking the circuit, supply must be switched off

RESULT:

SPEED CONTROL OF A D.C.SHUNT MOTOR

AIM:

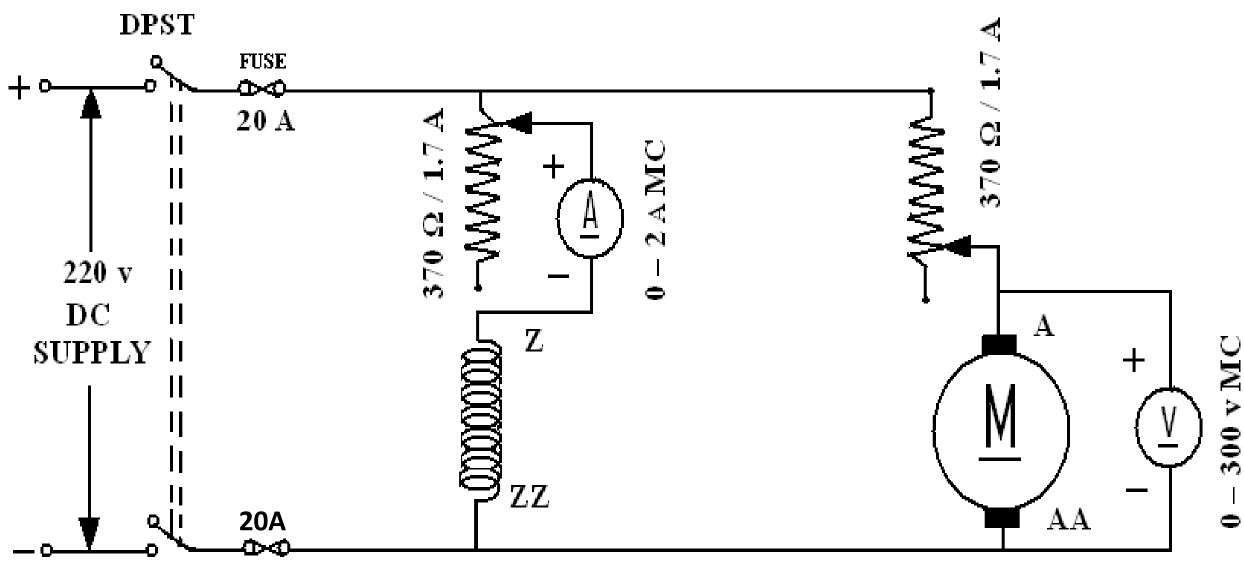
To vary the speed of the given d. c. shunt motor by armature control & field control methods and to pre-determine the efficiency of a D.C. Shunt Motor by Swinburne's method.

NAME PLATE DETAILS:

Motor

Voltage		Output	
Current		Speed	

CIRCUIT DIAGRAMS:



SPEED CONTROL OF DC SHUNT MOTOR

APPARATUS:

S.No.	Item	Type	Range	Quantity
1	Ammeter	(M.C)	0 – 2 A 0- 20 A	1 No 1 No
2	Voltmeter	(M.C)	0 – 300 Volts	1 No
3	Rheostat	Wire wound	370 ohms / 1.7 A	2 No
4	Tachometer	Digital	0-3000 rpm	1 No

Procedure of Speed control:

Part-A: <u>Armature control method</u>

1. Choose the proper ranges of meters after noting the name plate details of the given machine and make the connections as per the circuit diagram.
2. **Keep the motor field rheostat (R_{fm}) in the minimum position and the armature rheostat (R_{fg}) in the maximum position**, start the MG set.
3. Give supply and accelerate the motor by cutting out the armature circuit resistance (Ra) until rated voltage is applied to the armature.

4. Adjust the field rheostat (R_f) to make the motor run at its rated speed(N_s) when rated voltage is applied to the armature. This field current corresponds to normal excitation.

5. Keeping normal excitation, vary the armature voltage (V_a) by varying the armature resistance and note down the speed of the motor (N) for different voltages. Note down the field current also.

6. Tabulate these readings and plot the graph V_a Vs N.

Part-B: Field control method:

Apply rated voltage to the armature and vary the field current (I_f) by varying the field rheostat. Note down the speeds (N) at different values of field current. ***TAKE CARE THAT THE SPEED DOESN'T EXCEEED 2000 rpm.*** Note down the armature voltage also.

Tabulate these readings and plot the N V_s I_f describes the field control of motor speed on no load.

TABULAR COLUMN:

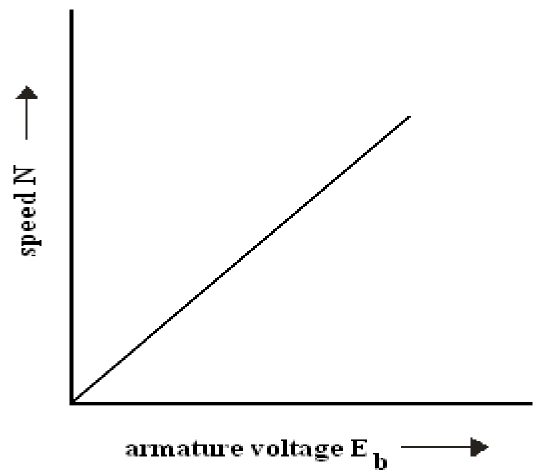
ARMATURE CONTROL METHOD

S. No.	Va	N	I_f

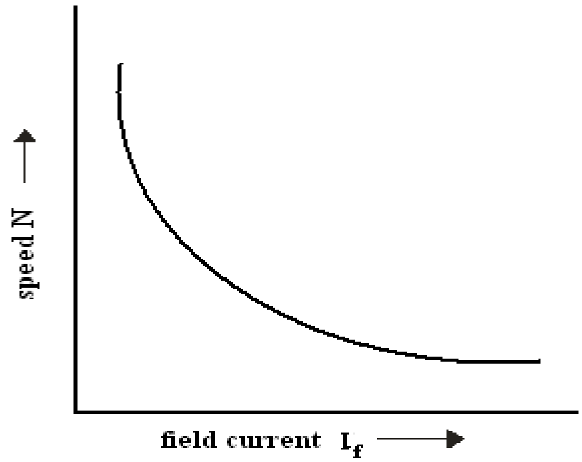
FIELD CONTROL METHOD

S. No.	Va	N	I_f

MODEL GRAPH:



a) armature control



b) field control

Viva Questions:

Speed control:

1. Explain why the graph of armature speed control of motor is linear?
2. What is the shape of the curve of field control of method motor speed? Explain why is it so?
3. What is the disadvantage of using armature control of speed on load?
4. How do you change the direction of rotation of a D.C. motor?
5. What are the limitations of shunt field control?
6. Comment on the efficiency calculated by this method.
7. Why do you need a starter in a dc motor?
8. What is meant by rated speed?
9. Can we start the dc shunt motor and series motor without load?
10. What is meant by speed regulation?
11. Can we operate a dc motor an ac supply?
12. Can we conduct continuity test on ac supply?
13. What are the other methods of controlling the speed of dc shunt motor?
14. While running if the field winding gets disconnected, what will happen?

RESULT:-