Title: **List of Experiments**	GPRECD/EEE/EXPT-PSP Date: 10-1-2023

List of Experiments

1. **IDMT Over Current Relay**
2. **Micro processor based IDMT Over current relay**
3. **Directional IDMT over current Relay**
4. **Micro processor based Directional over current relay**
5. **Inverse Time Over Current Relay**
6. **220 KV-180KM EHV-AC Long Transmission Line Simulator(Voltage regulation and determination of surge impedance)**
7. **Simulation of faults on a 3-phase unloaded alternator**
8. **Determination of +ve, -ve and zero sequence impedances of 3-phase alternator.**
9. **a) Load Flow Analysis using etap.**
   b) Short Circuit Analysis using etap
10. **a) Detection of Harmonic currents and filter design using etap**
    b) Determination of Transient Stability (Equal Area Criterion and Swing Equation) using etap.
11. **Optimal Power flow using etap.**
12. **Determination of +ve, -ve and zero sequence impedances of 3-phase transformer**
13. **Measurement of Earth resistance.**
14. **Study of oil testing kit and determination of dielectric strength.**
15. **Simulation of string insulators for the determination of voltage distribution and string efficiency.**

Prepared by:	Approved by:	Revision No: 1
Dr.G.Sreenivasa Reddy Associate Professor	Dr.K. Sri Gowri HOD, EEE Dept	

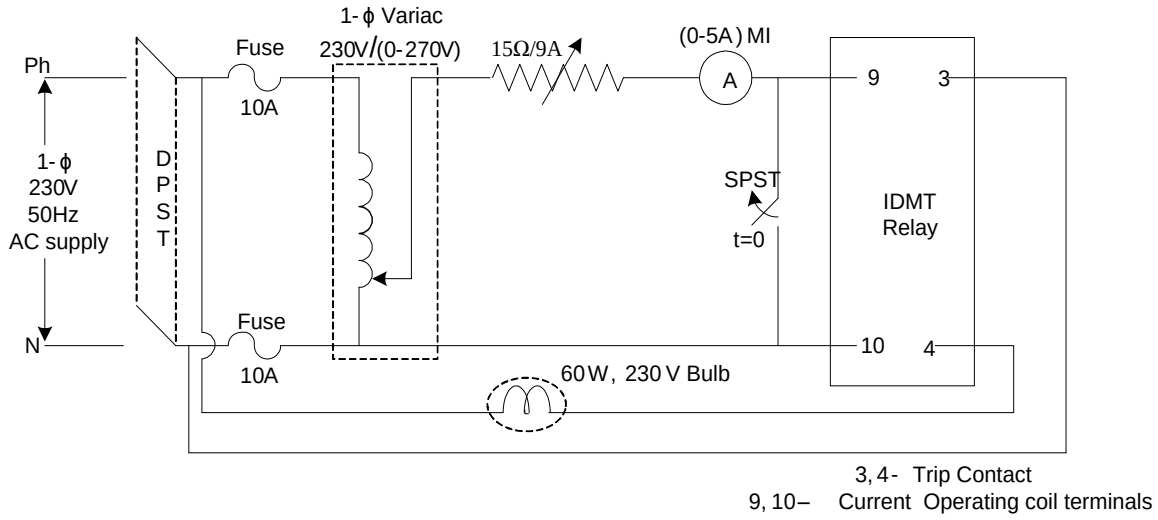
Title: **IDMT OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-1 Date: 10-1-2023

AIM: To study IDMT over current relay operation and to draw its characteristic curve.

APPARATUS:

Rheostat	(15Ω/ 9A)		- 1
Ammeter	(0 – 5A)	MI	- 1
SPST Switch			- 1
IDMT over current Relay Box			
Bulb	230V/60W		- 1
Auto transformer	(230/0-270V)		- 1

CIRCUIT DIAGRAM:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **IDMT OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-1 Date: 10-1-2023

THEORY:

Inverse Definite Minimum Time Over current(I.D.M.T.) Relay gives an inverse-time current characteristic at lower values of the fault current and definite – time characteristic at higher values of fault current.Generally,an inverse – time characteristic is obtained if the value of the plug setting multiplier is below 10. For values of plug setting multiplier between 10 and 20, the characteristic tends to become a Straight line, i.e towards the definite time characteristic. I.D.M.T. relays are widely used for the protection of distribution lines.Such relays have a provision for current and time setting. The following is the important characteristic of I.D.M.T. over current relay

$$t = \frac{0.14}{I^{0.02} - 1}$$

The magnetic circuit of an over current relay can be designed to saturate above a certain value of the actuating current. Below this value of actuating current, the relay gives an inverse characteristic. Above the saturation value of the current, the relay gives straight line characteristic, parallel to the current axis.

PROCEDURE:

1. Connect the circuit as per the figure.
2. Close the SPST switch and keep the rheostat at maximum position.
3. Now vary the auto transformer and set the current to certain value.
4. Open the switch ‘S’ and switch ON the stop clock.
5. Note down the time taken for operations of relay for different current settings.
6. Repeat the steps2,3,4 and 5 for different plug settings and note down the readings and do the same for different time operations.
7. Draw the graph with time on Y – axis and PSM on X – axis.

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **IDMT OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-1 Date: 10-1-2023

TABLES:

P.S = 50% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 50% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 75% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 75% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

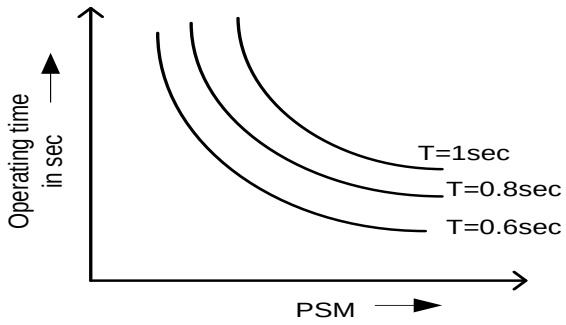
P.S = 100% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 100% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

EXPECTED GRAPHS:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **IDMT OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-1 Date: 10-1-2023

RESULT:
VIVA QUESTIONS:

1. What is protective relay ? Explain its function in an electrical system.?
2. Define the term Pick-up value ?
3. Define the term Plug-setting multiplier?
4. What is the difference between a fuse and a relay?
5 What are the essential elements of a protective relay?
6. Define the terms 'Sensitivity' and 'Selectivity of a relay'?
7. What is meant by operating time of protective relay?
8. Write the universal torque equation?
9. How are relay time, breaker time and fault clearing time related?
10. What is meant by relay setting?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

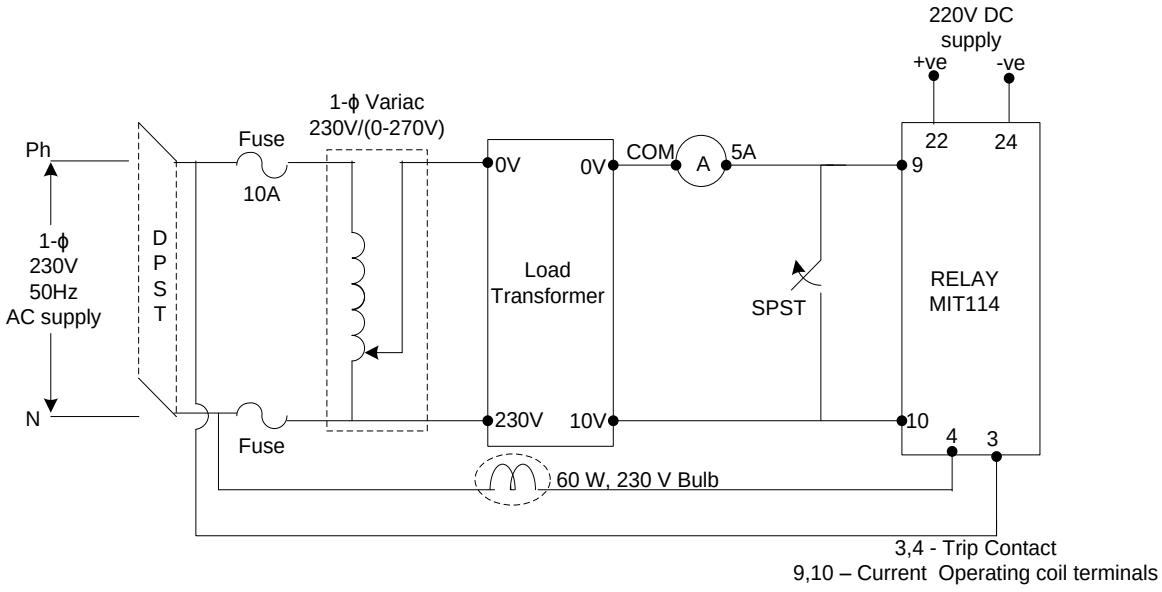
TITLE: **Micro processor based IDMT Over Current relay**	GPRECD/EEE/EXPT-PSP-2 Date: 10-1-2023

AIM:
To study Micro processor based IDMT over current relay operation and to draw its characteristic curve.

APPARATUS:

Load transformer	230V/(0-10V)		1
Ammeter	(0 – 5A)	MI	1
SPST Switch			1
Micro processor based IDMT over current Relay – MIT114			
Bulb	230V/60W		1
Auto transformer	(230/0-270V)		1

CIRCUIT DIAGRAM:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor based IDMT Over Current relay**	GPRECD/EEE/EXPT-PSP-2 Date: 10-1-2023

THEORY:

Modern power networks require faster, more accurate and reliable protective schemes. Microprocessor-based protective schemes are capable of fulfilling these requirements.They are superior to electromagnetic and static relays. These schemes have more flexibility due to their programmable approach when compared with static relays which have hardwired circuitry. With the same interfacing circuitry, a number of characteristics can be realized using different programs.Microprocessor-based schemes are more compact,accurate and fast.

There are two methods to realize overcurrent characteristics.One method employs a precision rectifier to convert ac signals to dc signals. Since the microprocessor-based system cannot process current signals, a voltage signal proposonal to load current is obtained.The ac voltage signal is rectified and then converted to digital quantity. The microprocessor compares this with a fixed reference (pick-up value) and take the decision for tripping.If the digital quantity,which is proposonal to load current,exceeds pick-up value, the microprocessor sends a trip signal to the circuit breaker after a prseset delay.

In second method, a number of samples of ac signal over one cycle or half cycle is taken.From these samples rms values can be computed. The computed rms values of load current are individually compared with pick up value and the desired time-current characteristic is realized.

PROCEDURE:

1. Connect the circuit as per the circuit diagram and switch ON DC supply, the Relay will be on.
2. SPST switch should be closed before giving AC supply.
3. Set CP (phase characteristics) to S13 (Standard 10 times 3 seconds).
4. Set IP (Phase characteristics current setting) for different values in steps of 20%.
5. By applying different values of currents with auto transformer note the trip time with Stop watch.
6. The same procedure is repeated for different values of IP setting (current setting).
7. Draw the graph with current on X – axis and time on Y – axis.

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor based IDMT Over Current relay**	GPRECD/EEE/EXPT-PSP-2 Date: 10-1-2023

TABLES:

I P =20%

SNO	I	T (sec)

I P =25%

SNO	I	T (sec)

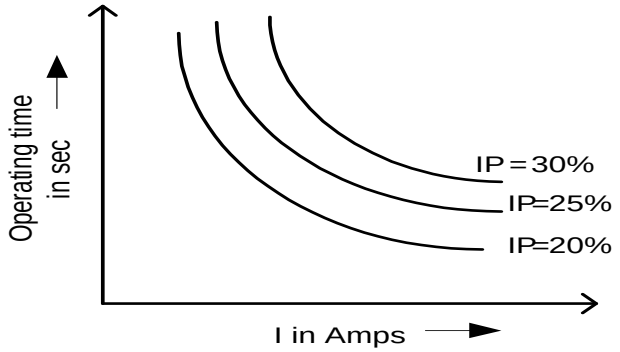
I P =30%

SNO	I	T (sec)

I P =40%

SNO	I	T (sec)

EXPECTED GRAPHS:



RESULT:

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor based IDMT Over Current relay**	GPRECD/EEE/EXPT-PSP-2 Date: 10-1-2023

VIVA QUESTIONS:

1. What is protective relay? Explain its function in an electrical system?
2. Define the term Pick-up value?
3. Define the term Plug-setting multiplier?
4. What are the main components of micro processor based IDMT Over current relay?
5 What are the advantages of micro processor based IDMT Over current relay?
6. Compare Static and electromagnetic relay?
7. What is meant by operating time of protective relay?
8. What is the function Multiplexer in IDMT Over current relay?
9. How are relay time, breaker time and fault clearing time related?
10. What is meant by relay setting?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

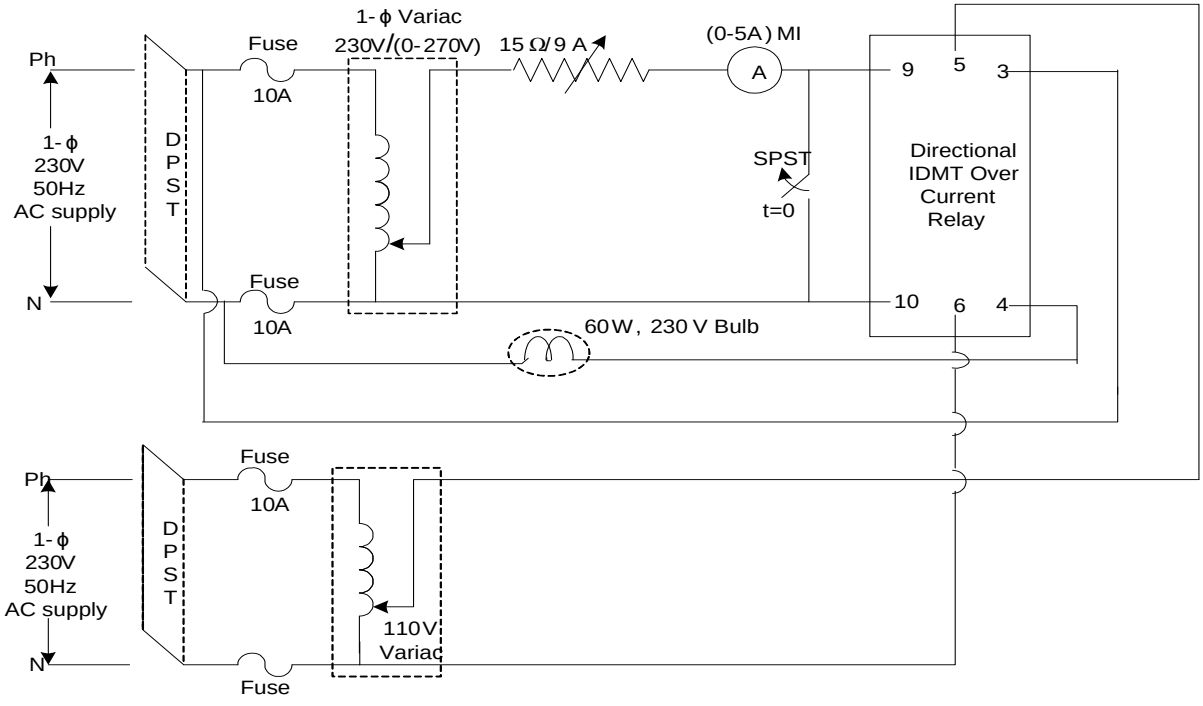
TITLE: **DIRECTIONAL OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-3 Date: 10-1-2023

AIM: To study a Directional over current relay operation and to draw its characteristic curve.

APPARATUS:

Rheostat	15Ω/9A	1
Ammeter	(0 – 5A) MI	1
SPST Switch		1
Relay Box		
Bulb	230V/60W	1
1- ϕ Auto transformer	(230/0-270V)	1
Stop watch		1

CIRCUIT DIAGRAM:



Prepared by: Dr.G.Sreenivasa Reddy, Associate Professor
Approved by: Dr.K.Sri Gowri, HOD, EEE Dept
Revision No: 0

TITLE: **DIRECTIONAL OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-3 Date: 10-1-2023

THEORY:

A directional over current relay operates when the current exceeds a specified value in a specified direction. It contains two relaying units, one overcurrent unit and the other directional unit. For directional control, the secondary winding of the overcurrent unit keptopen.When directional unit operates, it closes the open contacts of the secondary winding of the over current unit. Thus directional feature is attributed to the over current relay.The over current unit may be of either a wattmeter or shaded pole type. In a shaded pole type ,the opening is made in the shaded coil which is in this case a wound coil instead of an ordinary copper Strip.

PROCEDURE:

1. Connect the circuit as per the figure.
2. Close the SPST switch and keep the rheostat at maximum position.
3. Now vary the auto transformer and set the current to certain value.
4. Open the switch 'S' and switch ON the stop clock.
5. Note down the time taken for operations of relay for different current settings.
6. Repeat the steps2, 3, 4 and 5 for different plug settings and note down the readings and do the same for different time operations.
7. Draw the graph with time on Y – axis and PSM on X – axis.

TABLES:

P.S = 50% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 50% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

Prepared by: Dr.G.Sreenivasa Reddy, Associate Professor
Approved by: Dr.K.Sri Gowri, HOD, EEE Dept

TITLE: **DIRECTIONAL OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-3 Date: 10-1-2023

P.S = 75% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 75% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 100% T_{SM} = 1 sec

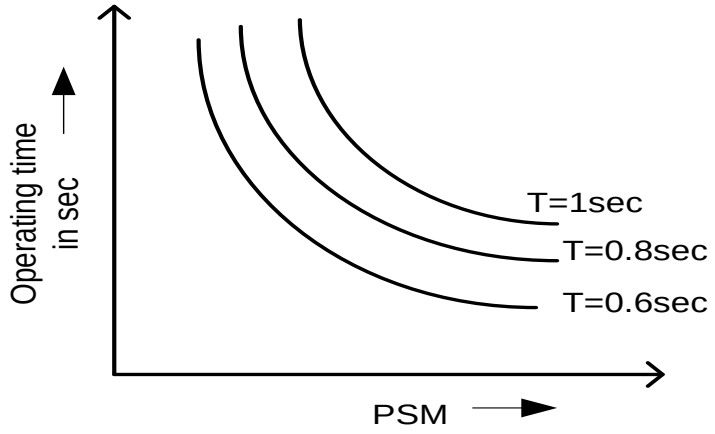
c

SNO	I	T (sec)	PSM=I/P.S

P.S = 100% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

EXPECTED GRAPHS:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Revision No: 0

TITLE: **DIRECTIONAL OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-3 Date: 10-1-2023

RESULT:

VIVA QUESTIONS:

1. What is protective relay ? Explain its function in an electrical system.?
2. Define the term Pick-up value ?
3. Define the term Plug-setting multiplier?
4. What is the difference between a fuse and a relay?
5. What are the essential elements of a protective relay?
6. Define the terms 'Sensitivity' and 'Selectivity of a relay'?
7. What is meant by operating time of protective relay?
8. Write the universal torque equation?
9 .Where is directional relay used?
10. What are the main features of directional relays?

Prepared by: Dr.G.Sreenivasa Reddy, Associate Professor
Approved by: Dr.K.Sri Gowri, HOD, EEE Dept

TITLE: **Micro processor Based Directional Over Current Relay**	GPRECD/EEE/EXPT-PSP-4 Date: 10-1-2023

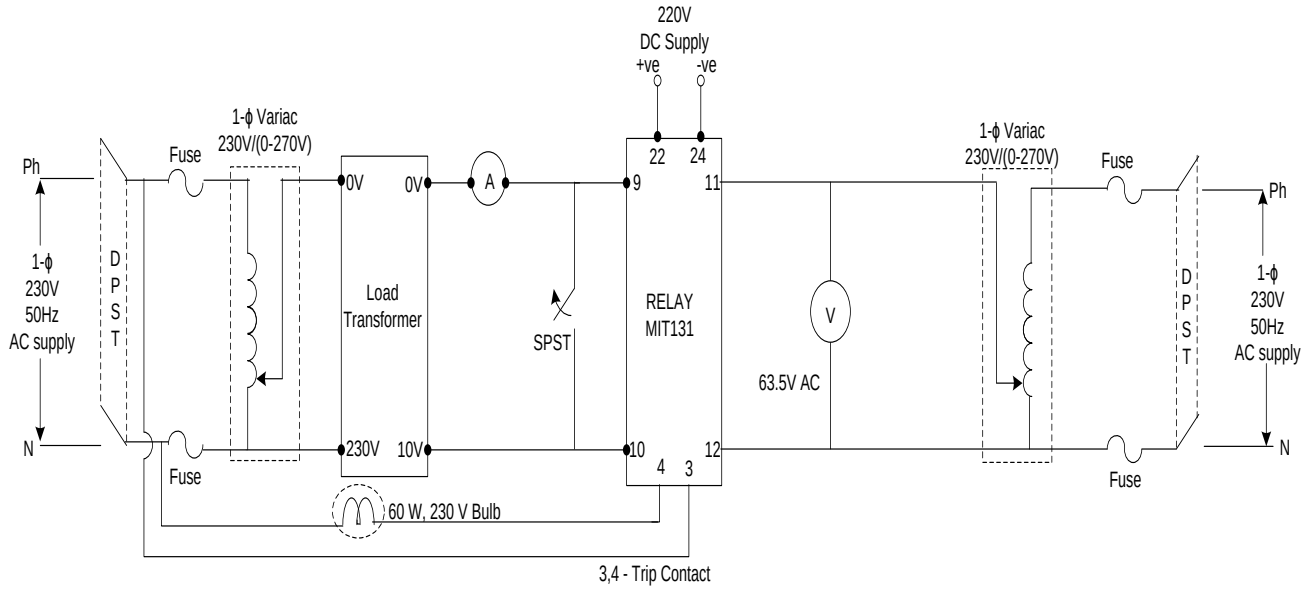
AIM:

To study Numerical directional (Micro processor based) over current relay operation and to draw its characteristic curve.

APPARATUS:

Load transformer	230V/(0-10V)		1
Ammeter	(0 – 5A)	MI	1
SPST Switch			1
Micro processor based IDMT over current Relay – MIT131			
Bulb	230V/60W		1
Auto Transformer	(230V/0-270V)		2

CIRCUIT DIAGRAM:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor Based Directional Over Current Relay**	GPRECD/EEE/EXPT-PSP-4 Date: 10-1-2023

THEORY:

A directional relay senses the direction of power flow. The polarity of the instantaneous value of the current at the moment of the voltage peak is examined to judge the direction of power flow. The program developed for this relay is able to judge whether the fault point is in the forward or reverse direction with respect to relay location. This relay can be used in conjunction with over current relays and impedance relays to provide directional features. when it is used as a directional relay, it energizes other relays only when the fault lies in the forward direction. It can also be used as a directional relay in conjunction with over current relays for the protection of parallel lines.

PROCEDURE:

1. Connect the circuit as per the circuit diagram. And switch ON DC supply, the Relay will be on.
2. SPST switch should be closed before giving AC supply.
3. Set CP (phase characteristics) to S13 (Standard 10 times 3 seconds).
4. Set IP (Phase characteristics current setting) 10 to 250 in step of 5.
5. Apply 63.5V on secondary Autotransformer.
6. By applying different values of currents (not exceeding 5 Amp) with the first auto transformer note the trip time with Stop watch.
7. The same procedure is repeated for different values of IP setting (current setting).
8. Draw the graph with current on X – axis and time on Y – axis.

TABLES:

I =100%

SNO	I	T (sec)

I =110%

SNO	I	T (sec)

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor Based Directional Over Current Relay**	GPRECD/EEE/EXPT-PSP-4 Date: 10-1-2023

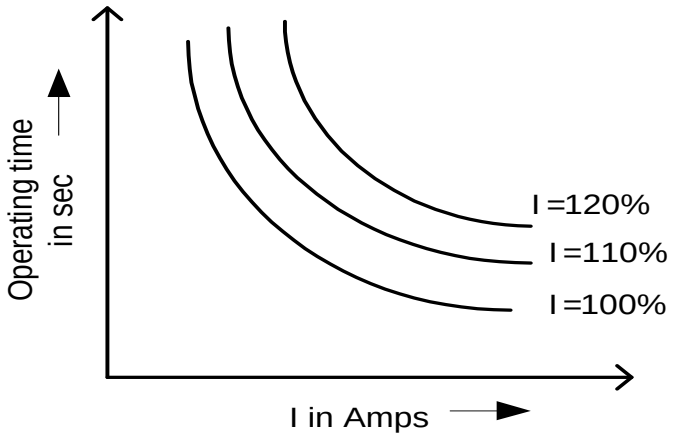
I =120%

S NO	I	T (sec)

I =130%

S NO	I	T (sec)

EXPECTED GRAPHS:



RESULT:

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Micro processor Based Directional Over Current Relay**	GPRECD/EEE/EXPT-PSP-4 Date: 10-1-2023

VIVA QUESTIONS:

1. What is protective relay ? Explain its function in an electrical system.?
2. Define the term Pick-up value ?
3. Define the term Plug-setting multiplier?
4. What are the main components of Numerical Directional overcurrent relay?
5. What are the advantages of micro processor based Directional Over current relay?
6. What is the function of Load transformer ?
7. What is meant by operating time of protective relay?
8. Write the universal torque equation?
9 .Where is directional relay used?
10. What are the main features of directional relays?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

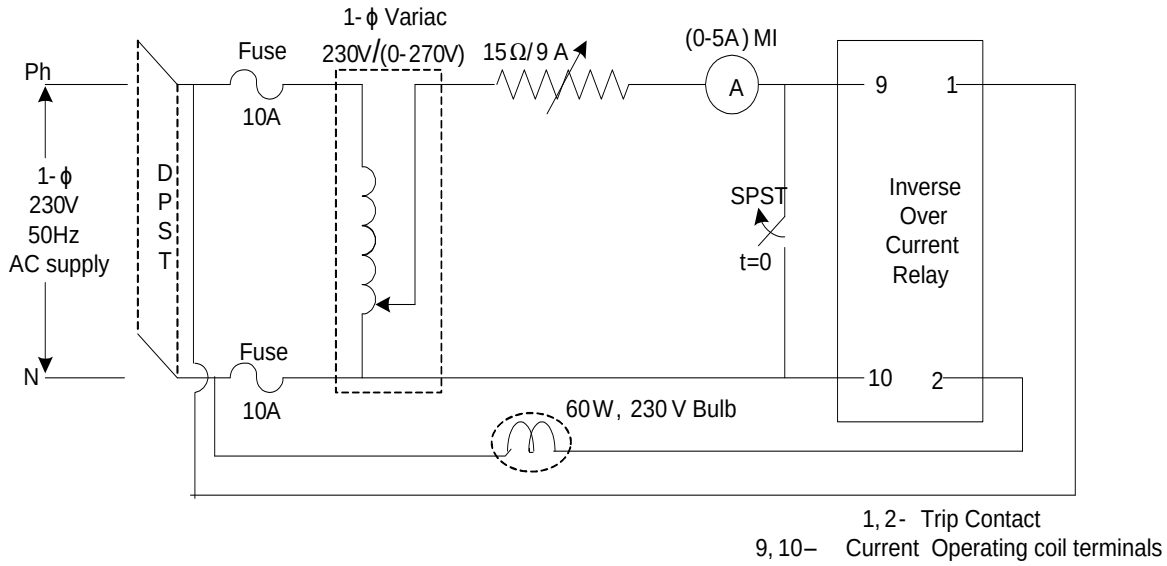
Title: **INVERSE OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-5 Date: 10-1-2023

AIM : To study a Inverse over current relay operation and to draw its characteristic curve.

APPARATUS:

Rheostat	15Ω/9A		1
Ammeter	(0 – 5A)	MI	1
SPST Switch			1
Inverse over current Relay Box			
Bulb	230V/60W		1
1- ϕ Auto Transformer (230/0-270V)			1
Stop watch			1

CIRCUIT DIAGRAM:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **INVERSE OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-5 Date: 10-1-2023

THEORY:

Inverse - time over current relay operates when the current exceeds its pick up value. Pick up value current is the minimum current in the relay coil at which relay starts to operate. The operating time depends on the magnitude of the operating current. The operating time decreases as the current increases. This type of relay gives an inverse-time current characteristic at lower values of the fault current and definite-time characteristic at higher values of fault current. Generally, an inverse -time characteristic is obtained if the value of the plug setting multiplier is below 10.

A very inverse-time over current relay gives more inverse characteristic than of a plain inverse relay or I.D.M.T.Relay.It's time-current characteristic lies between an I.D.M.T.characteristic and extremely inverse characteristic.The very inverse characteristic gives better selectivity than I.D.M.T.characteristic.

An extremely inverse time overcurrent relay gives a time-current characteristic more inverse than that of the very inverse and I.D.M.T.Relays.When I.D.M.T. and very inverse relays fail in selectivity, extremely inverse relays are employed. An extremely inverse relay is very suitable for the protection of machines against overheating.

PROCEDURE:

1. Connect the circuit as per the figure.
2. Close the SPST switch and keep the rheostat at maximum position.
3. Now vary the auto transformer and set the current to certain value.
4. Open the switch 'S' and switch ON the stop clock.
5. Note down the time taken for operations of relay for different current settings.
6. Repeat the steps2,3,4 and 5 for different plug settings and note down the readings and do the same for different time operations.
7. Draw the graph with time on Y – axis and PSM on X – axis.

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **INVERSE OVER CURRENT RELAY** GPRECD/EEE/EXPT-PSP-5
Date: 10-1-2023

TABLES:

P.S = 50% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 50% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 75% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 75% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

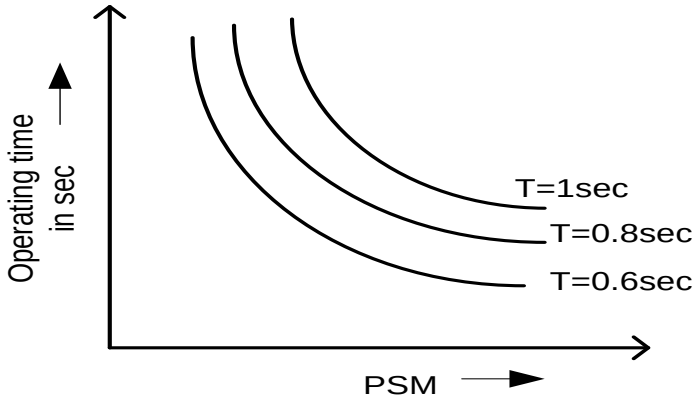
P.S = 100% T_{SM} = 1 sec

SNO	I	T (sec)	PSM=I/P.S

P.S = 100% T_{SM} = 0.5 sec

SNO	I	T (sec)	PSM=I/P.S

EXPECTED GRAPHS:



RESULT:

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

Title: **INVERSE OVER CURRENT RELAY**	GPRECD/EEE/EXPT-PSP-5 Date: 10-1-2023

VIVA QUESTIONS:

1. What is protective relay ? Explain its function in an electrical system.?
2. Define the term Pick-up value ?
3. Define the term Plug-setting multiplier?
4. What is the difference between a fuse and a relay
5. What are the essential elements of a protective relay?
6. Define the terms 'Sensitivity' and 'Selectivity of a relay'?
7. What is meant by operating time of protective relay?
8. Write the universal torque equation?
9. How are relay time, breaker time and fault clearing time related?
10. What is meant by relay setting?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **220 KV – EHVAC (180 KM) LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

AIM:

To conduct an experiment on 220 KV – EHV AC (180 KM) long line and to determine the following;

a) Ferranti effect.
b) ABCD parameters and Surge impedance.

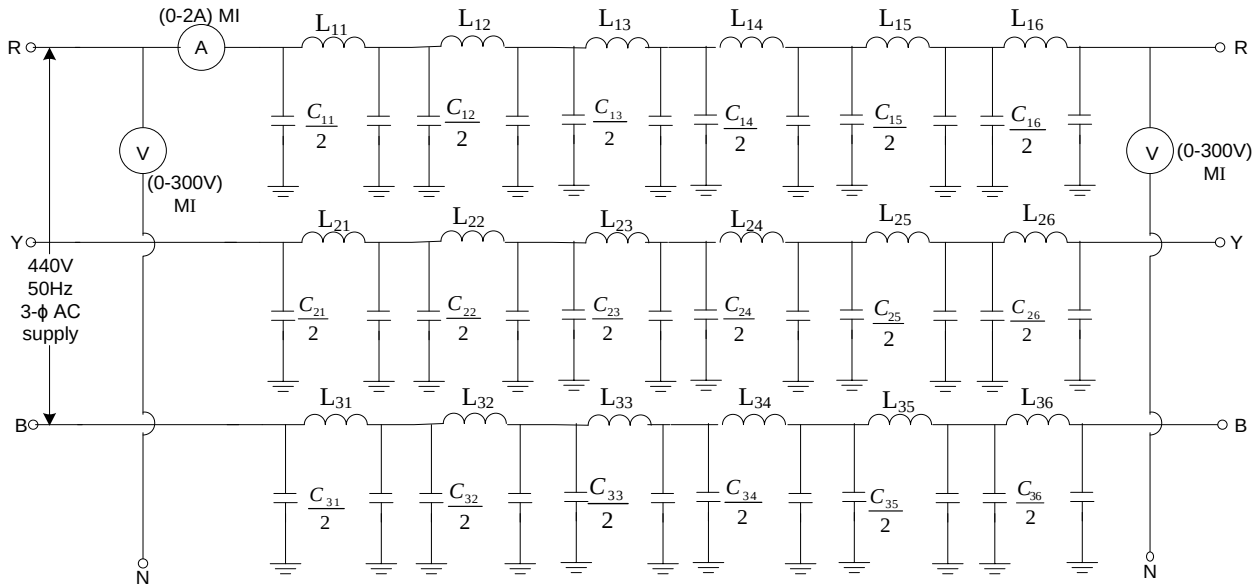
APPARATUS:

22O KV – EHV AC, 180 KM long transmission line simulator
Loading rheostat (5 KW, 230V AC)

Connecting Leads			Required No
Ammeter	(0-2A)	MI	1
Ammeter	(0-5A)	MI	1
Voltmeter	(0-300V)	MI	2

CIRCUIT DIAGRAM:

OC TEST:

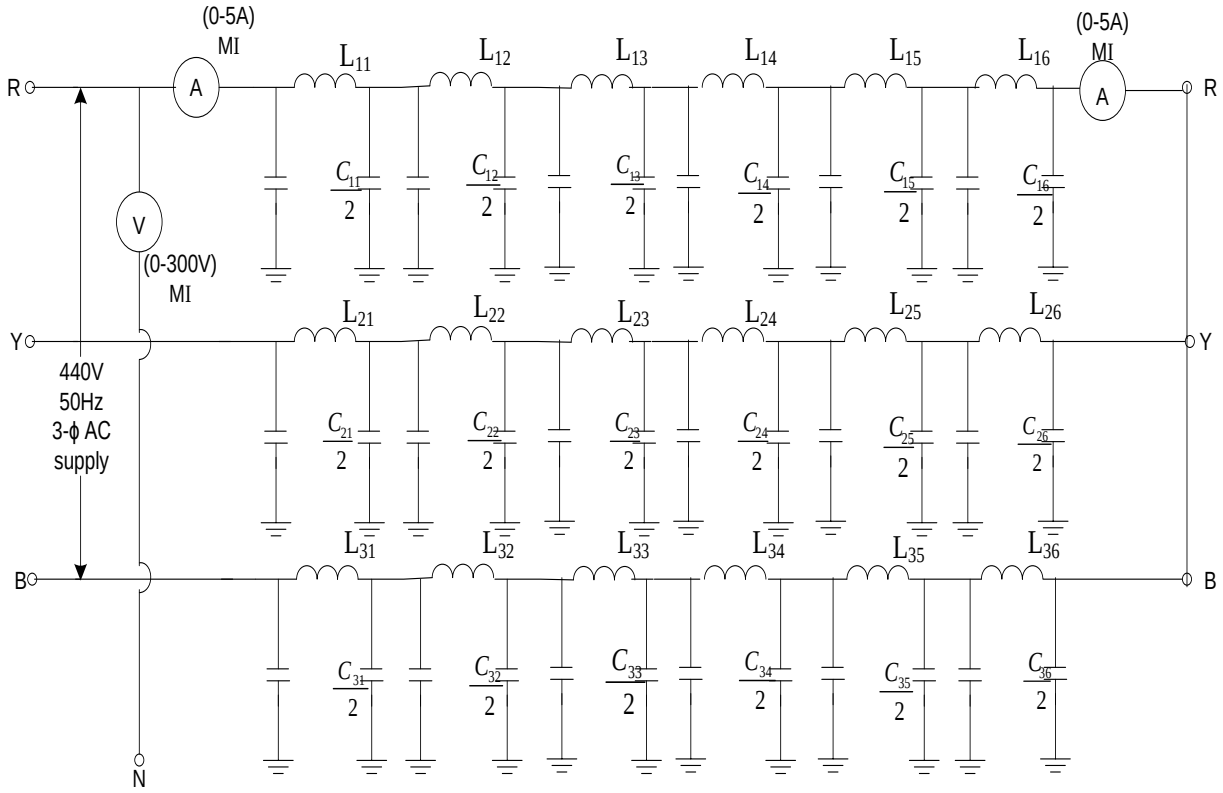


Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **220 KV – EHVAC (180 KM) LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

SC TEST:



THEORY:

A transmission line has three constants R, L and C distributed uniformly along the whole length of the line. The resistance and inductance form series impedance. The capacitance existing between conductors for 1-phase line (or) from a conductor to neutral, for a 3-phase line forms a shunt path throughout the length of the line. The overhead transmission lines are classified depending upon in which the capacitance is consider.Depending upon the length and operating voltage the transmission lines are classified as short, medium & long transmission lines.

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **220 KV – EHVAC (180 KM) LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

The length of an over head transmission line less than 80KM and operating voltage less than 20KV, it is considered as a short transmission line. Transmission lines having length between 80KM and 200KM and line voltages between 20KV and 100KV considered as medium transmission lines. The transmission lines having length above 200KM and linevoltage above 100KV, the line consider as long transmission line.

The square root of the ratio of line impedance (Z) and Shunt admittance (Y) is called the surge impedance (Z_0) of the line. Surge impedance is also called characteristic impedance (Z_c). The surge impedance value varies between 400Ω and 600Ω in case of overhead transmission lines and between 40Ω and 60Ω in case under ground cables.

When a long line is opened under no load (or) light load condition, the receiving end voltage is greater than the sending end voltage, this is known as Ferranti effect.

PROCEDURE:

Ferranti effect:

1. Supply is given to the simulator.
2. Receiving end side is open circuited.
3. Voltages at sending end and Receiving end are noted.

ABCD parameters:

I. OPEN CIRCUIT TEST:

1. Receiving end of simulator is open circuited.
2. Supply is given to simulator.
3. Sending end voltage, current and receiving end voltages are noted.

II. SHORT CIRCUIT TEST:

1. Receiving end side of the simulator is short circuited .
2. Supply is given to the simulator.
3. Sending end voltage and current and receiving end side current are noted.

III. ABCD parameters are calculated from the given expression.

Surge impedance of the line is calculated as $Z_S = \sqrt{(Z_{OC} * Z_{SC})}$

Where $Z_{OC} = V_S/I_S$ = A/C (From O.C. TEST**)** and $Z_{SC} = = V_S/I_S$ = B/D (From S.C.TEST).

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **220 KV – EHVAC (180 KM) LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

OBSERVATIONS:

O.C.TEST

V_S	I_S	V_R

S.C.TEST

V_S	I_S	**I_R**

RESULT:

VIVA QUESTIONS:

1. What is the purpose of an overhead transmission line? How are these lines classified?
2. Define the terms voltage regulation and transmission efficiency as applied to transmission line.
3. Define surge impedance & surge impedance loading?
4. Define the Ferranti effect in overhead transmission lines?
5. How will you define the generalized constants of transmission lines?
6. Write the A,B,C & D values for long transmission lines?
7. What is the effect of line capacitance on the line performance?
8. What are the units of the generalized constants of transmission lines?
9. What is the range of Surge impedance for an overhead transmission lines?
10. What is the range of Surge impedance in case of Underground cables?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **LOADING OF LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

AIM:

To determine voltage regulation for the EHV AC [220 KV, 180KM] Long transmission line simulator.

APPARATUS:

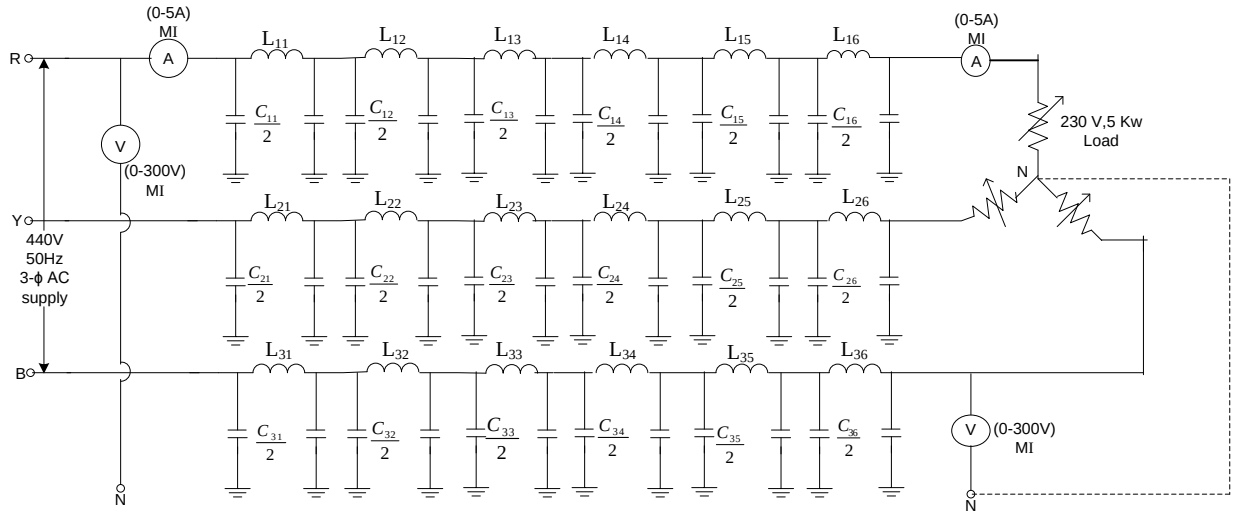
220KV, 180KM, EHV AC long transmission line simulator

Voltmeter	(0 – 300V)	MI	2
Ammeter	(0 – 10A)	MI	2

3 - ϕ, 5 KW Loading Rheostat.

Connecting wires required number

CIRCUIT DIAGRAM:



Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **LOADING OF LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

THEORY:

A transmission line has three constants R, L and C distributed uniformly along the whole length of the line. The resistance and inductance form series impedance. The capacitance existing between conductors for 1-phase line (or) from a conductor to neutral, for a 3-phase line form a shunt path throughout the length of the line. The overhead transmission lines are classified depending upon in which the capacitance is considers. Depending upon the length and operating voltage the transmission lines are classified as short, medium & long transmission lines.

The length of an over head transmission line less than 80KM and operating voltage less than 20KV, it is considered as a short transmission line. Transmission lines having length between 80KM and 200KM and line voltages between 20KV and 100KV considered as medium transmission lines. The transmission lines having length above 200KM and line voltage above 100KV, the line consider as long transmission line.

While studying the performance of transmission line, it is desirable to determine its voltage regulation and transmission efficiency.

When a transmission line is carrying current, there is a voltage drop in the line due to resistance and inductance of the line. The result is that receiving end voltage (V_R) of the line is generally less than the sending end voltage (Vs). This voltage drop ($V_S - V_R$) in the line is expressed as a percentage of receiving voltage V_R and is called voltage regulation.

The difference in voltage at the receiving end of a transmission line between conditions of no load and full load is called "Voltage regulation" and is expressed as a percentage of the receiving end Voltage.

PROCEDURE:

1. Connect the circuit as shown in figure.
2. Connect a 3 - ϕ loading Rheostat at load side
3. By varying the load gradually note the value of voltage and current at sending end and receiving end..
4. Calculate the regulation of the transmission line.

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **LOADING OF LONG TRANSMISSION LINE** GPRECD/EEE/EXPT-PSP-6
Date: 10-1-2023

TABLE:

SNO	V_S	I_S	V_R	I_R	Voltage Regulation. $(V_S - V_R) / V_R X100$.

RESULT:

VIVA QUESTIONS:

1. What is the purpose of an overhead transmission line? How these lines are classified?
2. Define the terms voltage regulation and transmission efficiency as applied to transmission line
3. Define surge impedance & surge impedance loading?
4. Define the Ferranti effect in overhead transmission lines?
5. How will you define the generalized constants of transmission lines?
6. Write the A, B, C & D values for long transmission lines?
7. What is the effect of line capacitance on the line performance?
8. What are the units of the generalized constants of transmission lines?
9. What is the range of Surge impedance for an overhead transmission lines?
10. What is the range of Surge impedance in case of Underground cables?

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

AIM:

Conduct an experiment to simulate faults on an unloaded alternator by creating fault with fault resistance (z_f) and comparing these values with the theoretical values.

APPARATUS:

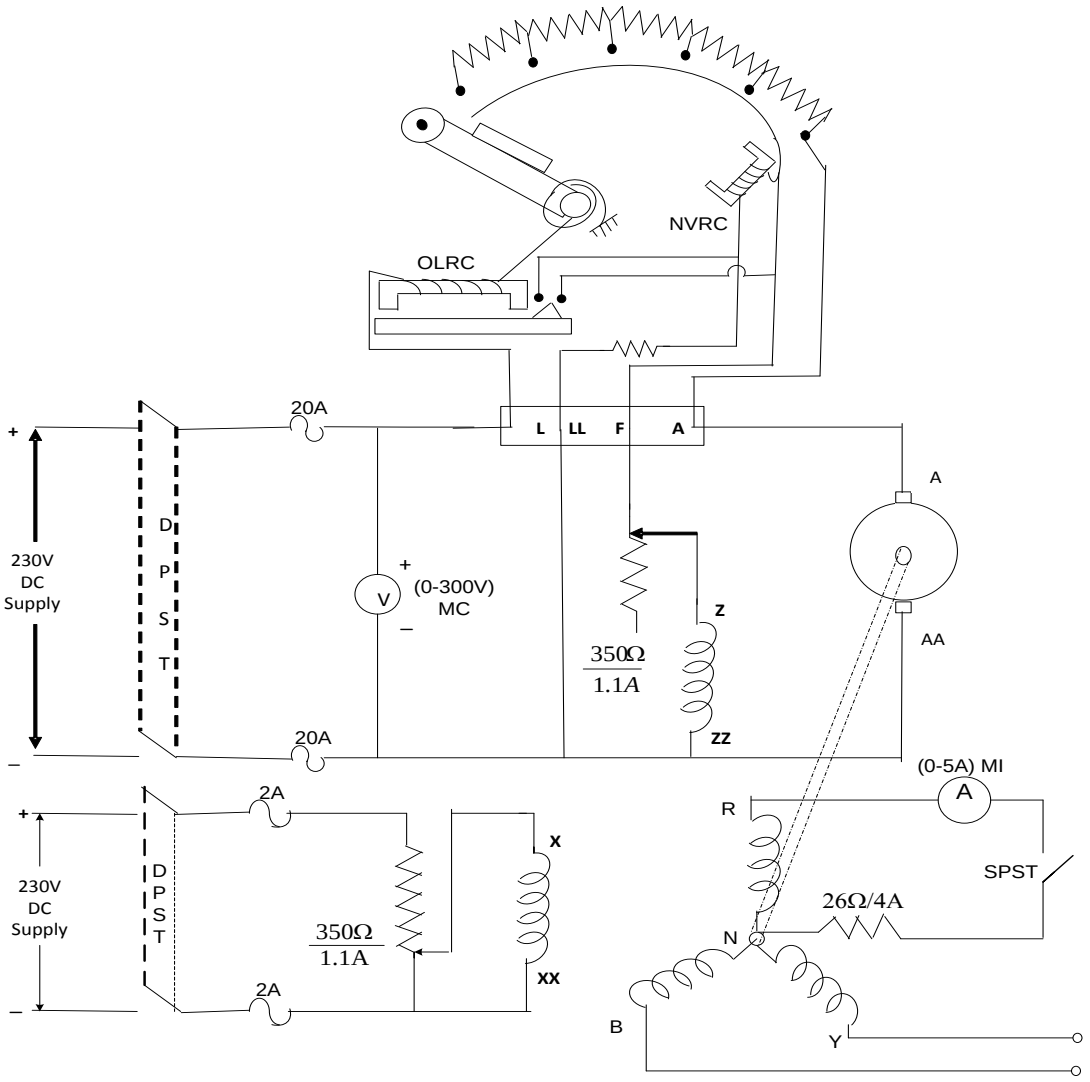
Rheostats	350Ω/1.2A		2
	26Ω/4.1A		2
Ammeter	(0 – 5A)	MI	2
Volt meter	(0 – 300V)	MC	1
Multimeter			1
SPST Switches			2

NAME PLATE DETAILS:

CIRCUIT DIAGRAM:

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

Single line to ground fault with and without fault impedance Z_f

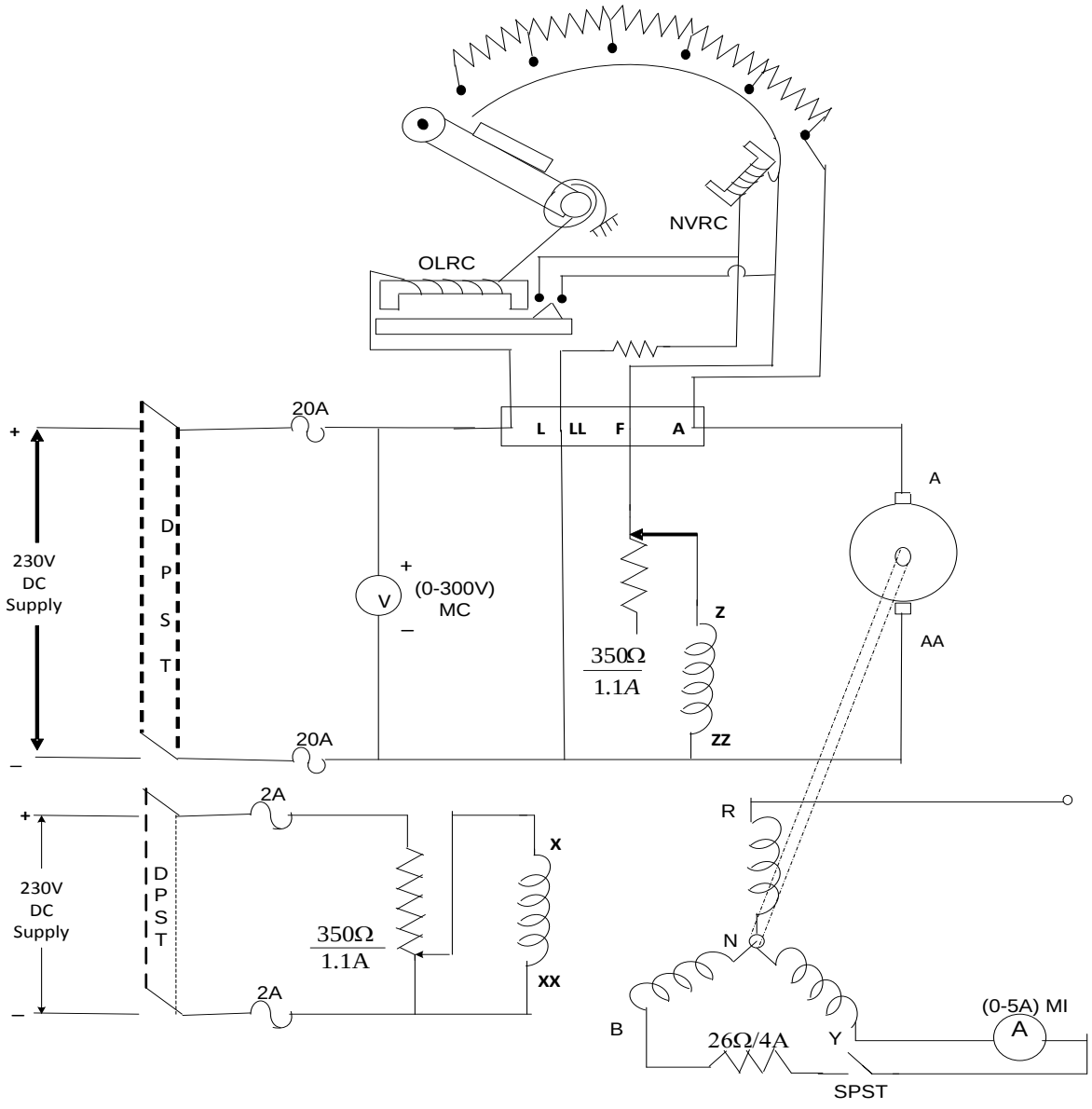


Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

Line to Line fault with and without fault impedance Z_f

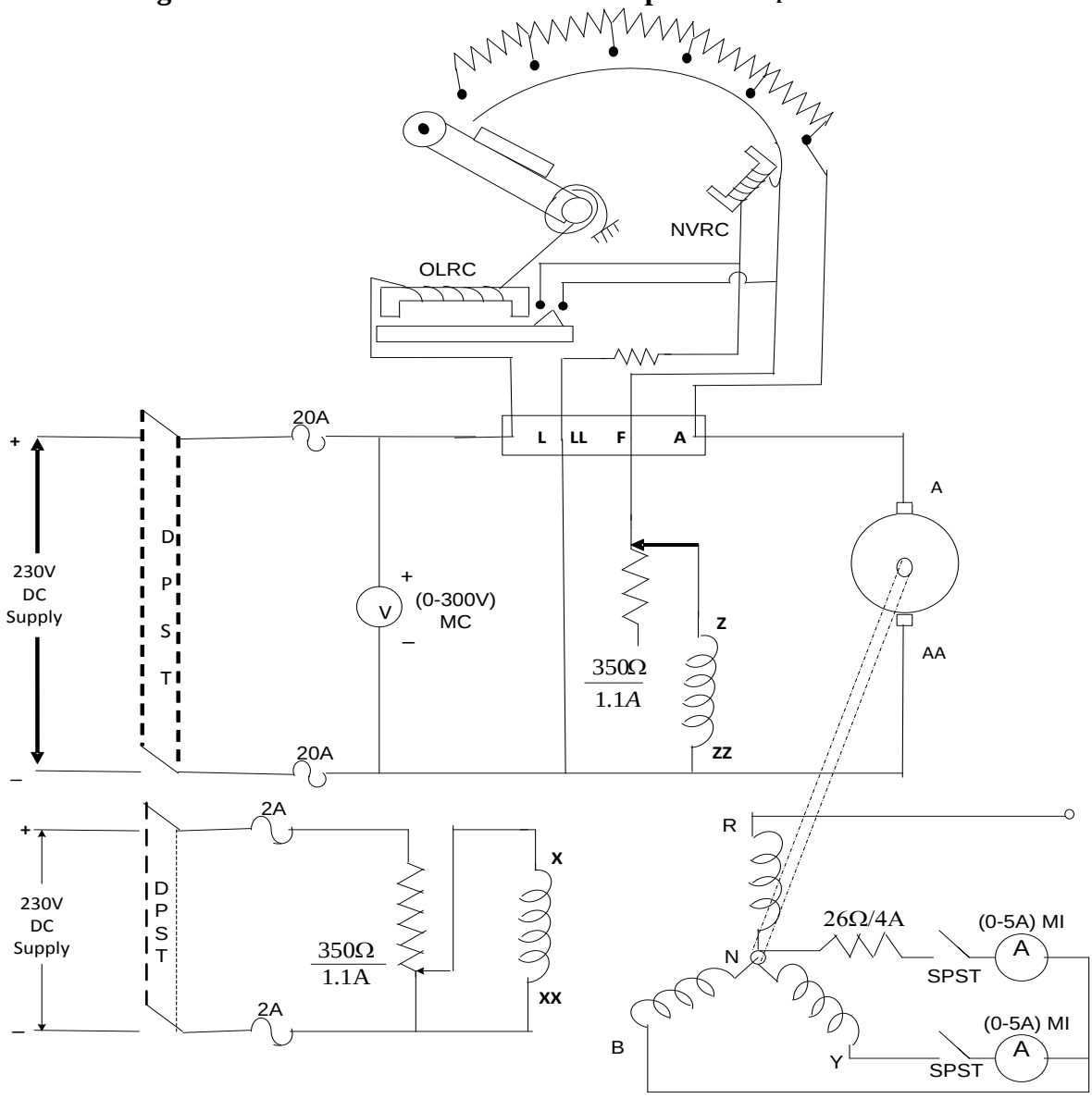


Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

Double line to ground fault with and without fault impedance Z_f



Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

THEORY:

Faults are classified as Shunt faults and Series faults.The Shunt type faults are classified as single line to ground fault, Line to line fault, double line to ground fault and 3-phase fault. In the above faults first three are unsymmetrical faults. Fourth one is symmetrical fault (i.e.) three phase faults.

Shunt faults are characterized by increase in current and fall in voltage and frequency.(p f). Series faults are classified as (1) One open conductor (2) Two open conductors. Series faults are characterized by increase in voltage and frequency and fall in current in faulted phases.

The positive sequence component of voltage at the fault point is $V_{R1} = Ea - I_{R1} Z_1$

The Negative sequence component of voltage at the fault point is $V_{R2} = - I_{R2} Z_2$

The Zero sequence component of voltage at the fault point is $V_{R0} = - I_{R0} Z_0$

The line to ground fault take place on phase R.

The boundary conditions are $V_R = 0$; $I_Y = 0$; $I_B = 0$.

The line to line fault take place on phases Y & B.

The boundary conditions are $I_R = 0$; $I_Y + I_B = 0$: $V_B = V_C$.

The Double line to ground fault take place on phases Y & B.

The boundary conditions are $I_R = 0$; $V_B = 0$; $V_C = 0$.

PROCEDURE:

1. Connect the circuit as shown in fig.
2. Adjust the speed of the motor to rated speed.
3. Vary the excitation of alternator to minimum position and close the SPST switch.
4. Slowly increase the excitation until the fault current is equal to rated current of alternator and note down the line and phase voltages.
5. The above procedure is repeated for different types of fault with fault impedance Z_f and with out Z_f .

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

TABLE:

S.NO	Type of fault	Pre-fault voltage	V_{RN}	V_{YN}	V_{BN}	V_{RY}	V_{YB}	V_{BR}	Fault current (A)	
1 2 3	LG LL LLG									With out Z_f
1 2 3	LG LL LLG									With Z_f

RESULT:

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SIMULATION OF FAULTS** GPRECD/EEE/EXPT-PSP-7
Date: 10-1-2023

VIVA QUESTIONS:

1. What are the different types of faults which occurs in power system?
2. What are unsymmetrical faults?
3. Draw the sequence network for single line – to –ground fault without fault impedance?
4. What are the uses of symmetrical components in power system?
5. Draw the sequence network for line – to –line fault without fault impedance?
6. What do you understand by a short-circuit ?
7. What is the importance of short-circuit calculations?
8. Draw the sequence network for Double line – to –ground fault without fault impedance?
9. What do you understand by percentage reactance? Why do we prefer to express the reactance of various elements in percentage values for short-circuit calculations?
10. What is the Symmetrical fault?

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

AIM:

a) To determine the positive sequence impedance of an alternator.
b) To find the negative sequence and zero sequence impedances of a given synchronous machine.

APPARATUS:

Ammeter	(0 – 2A)	MC	1
	(0 – 10A)	MI	1
	(0 -- 20A)	MI	1
Voltmeter	(0 – 75V)	MI	1
	(0 – 300V)	MI	1
	(0 – 500V)	MI	1
Tachometer			1
Connecting wires			required numer

NAME PLATE DETAILS:

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

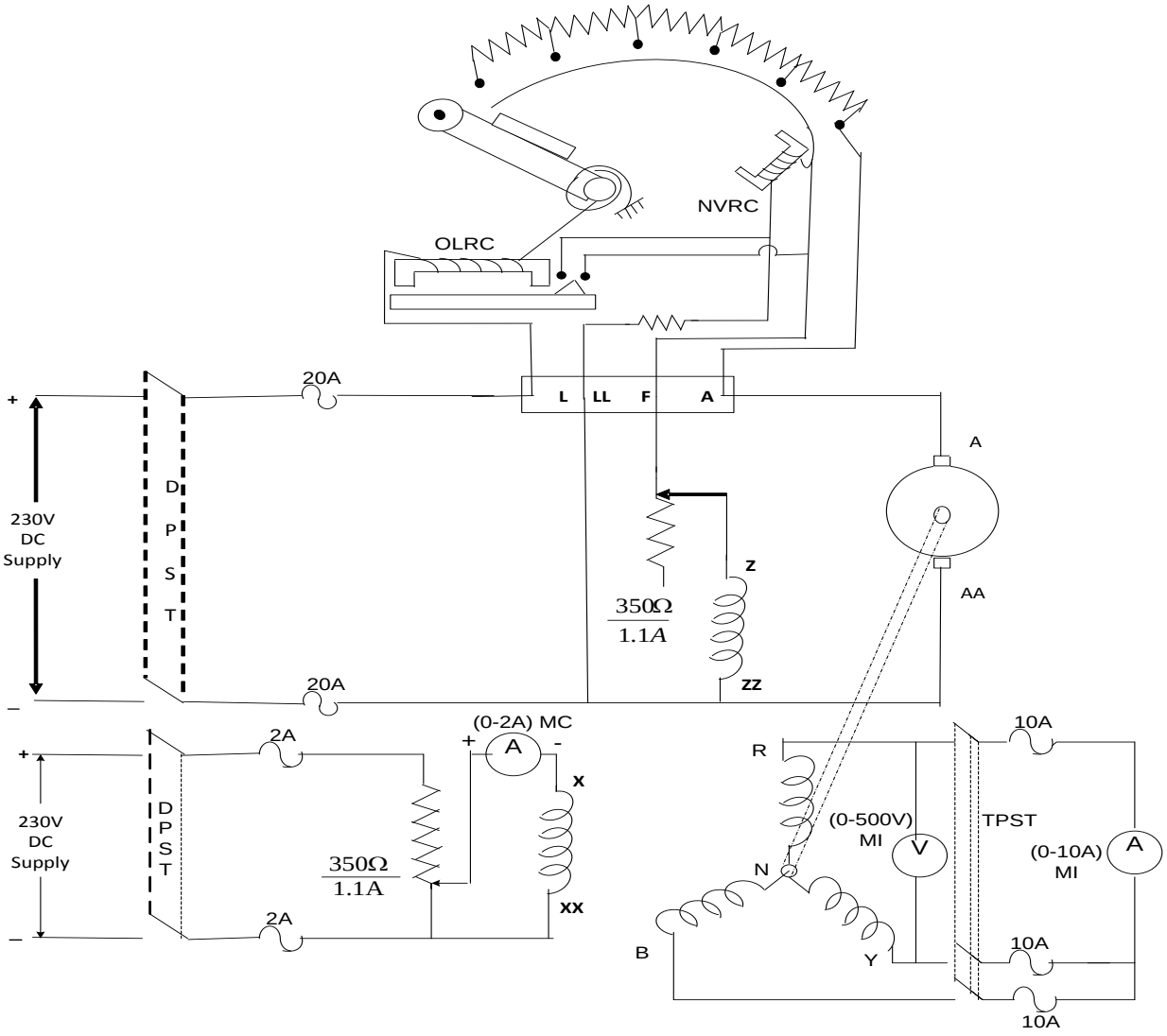
Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

CIRCUIT DIAGRAM:

POSITIVE SEQUENCE NETWORK DIAGRAM



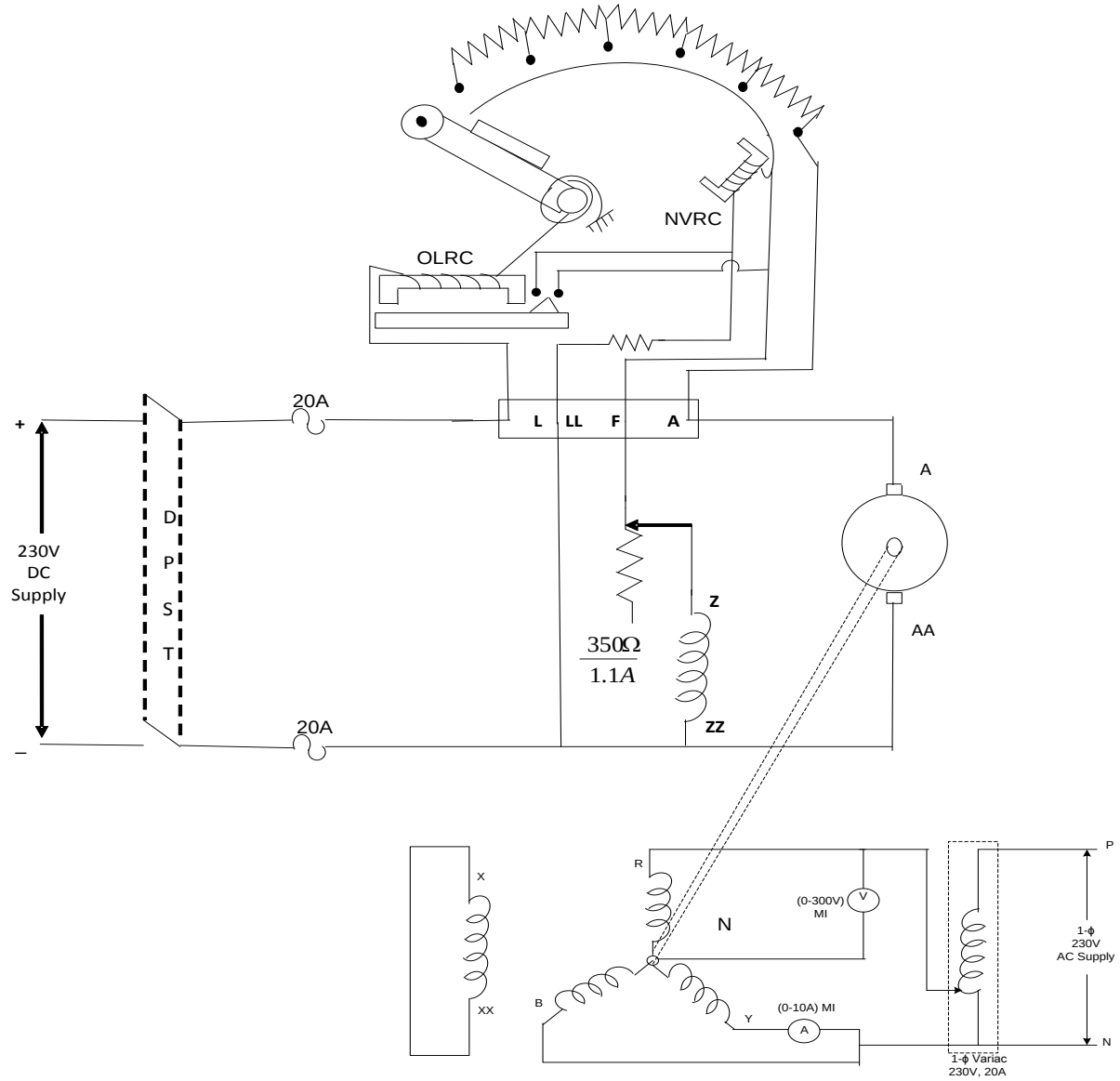
Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

NEGATIVE SEQUENCE NETWORK DIAGRAM



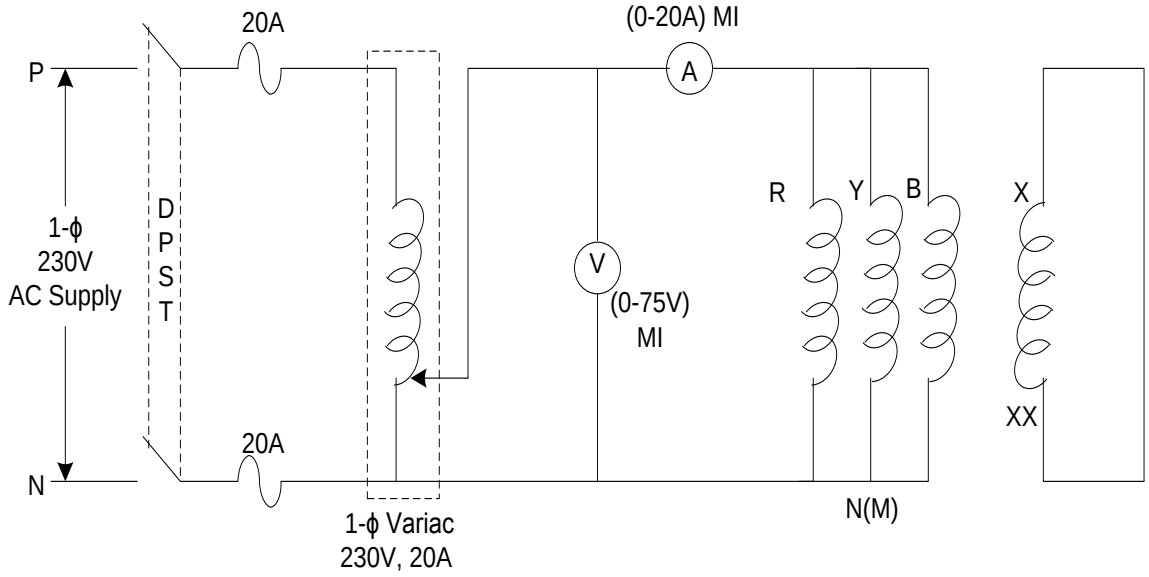
Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

ZERO SEQUENCE NETWORK DIAGRAM



THEORY:

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

Each element of power system will offer impedance to different phase sequence components of current which may not be same. In unsymmetrical fault calculations, each piece of equipment will have three values of impedance – one corresponding to each sequence current i.e Positive sequence impedance(Z_1), negative sequence impedance(Z_2), Zero sequence impedance (Z_0).

The impedance offered by the equipment or circuit to positive sequence current is called positive sequence impedance and is represented by Z_1.Similarly, impedances offered by any circuit or equipment to negative and zero sequence currents are respectively called negative sequence impedance (Z_2), and zero sequence impedance (Z_0).

The positive, negative and zero sequence impedances of rotating machines are generally different. The positive sequence impedance of a synchronous generator is equal to the synchronous impedance of the machine. The negative sequence impedance is much less than positive sequence impedance. The Zero sequence impedance is much less than negative sequence impedance.

The positive, negative and zero sequence impedances of a solidly grounded system under steady state condition always $Z_1 > Z_2 > Z_0$.

PROCEDURE:

FOR POSITIVE SEQUENCE IMPEDANCE:

1. Run the synchronous machine at 1500 RPM which corresponds to synchronous speed at 50 Hz frequency.
2. Vary the field current and measure the open circuit voltage go up to 125% of the rated voltage.
3. Adjust the excitation gradually and note down the excitation which goes the rated short circuit current.

FOR NEGATIVE SEQUENCE IMPEDANCE:

1. Run the machine at the rated speed.
2. Now the excitation is adjusted until the current through the short circuit is equal to rated current.
3. The voltmeter, Ammeter readings are noted.

Formula: $Z_2 = V/I$

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

FOR ZERO SEQUENCE IMPEDANCE:

1. The circuit is connected as shown in above fig.
2. The voltmeter and ammeter readings are noted when the current through the ammeter reads three times full load current.

Formula: $Z_O = 3V/I$.

TABLE:

POSITIVE SEQUENCE IMPEDANCE:

O.C TEST:

SNO	Field Current (A)	Open circuit voltage (V)

S.C TEST:

SNO	Field current (A)	Short Circuit current (A)

NEGATIVE SEQUENCE IMPEDANCE:

S.NO.	Current (A)	Voltage (V)

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

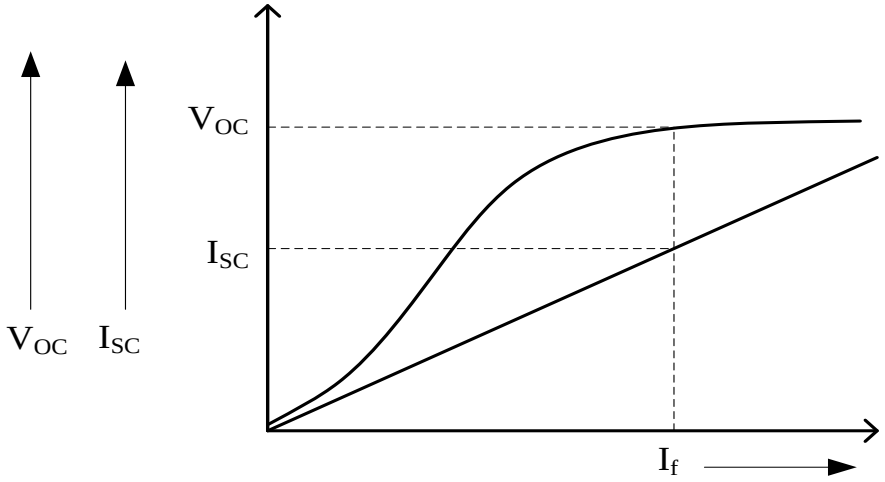
Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**	GPRECD/EEE/EXPT-PSP-8 Date: 10-1-2023

ZERO SEQUENCE IMPEDANCE:

S.NO.	Current (A)	Voltage (V)

EXPECTED GRAPH:



RESULT:

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

TITLE: **DETERMINATION OF +VE,-VE, ZERO SEQUENCE IMPEDANCES OF ALTERNATOR**

GPRECD/EEE/EXPT-PSP-8
Date: 10-1-2023

VIVA QUESTIONS:

1. Define the positive, negative & zero sequence impedance?
2. Draw the positive sequence network for Synchronous machine*?*
3. What are the relation between positive, negative & zero sequence impedances of synchronous machine?
4. Draw the negative sequence network for Synchronous machine?
5. Draw the zero sequence network for Synchronous machine?
6. What is the reason short the X-XX terminal of excitation of the machine in negative and zero sequence network?
7. What is operator '*a*'?
8. What do you understand by positive, negative and zero sequence impedances? Discuss them with reference to synchronous generators, transformers and transmission lines?
9. What do you understand by sequence networks?
10. What is the main difference between Alternator and D.C generator?

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K Sri Gowri
HOD, EEE Dept

Title: **Load Flow Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

Aim: To study the load flow analysis and to determine the voltage, and real and reactive power across each branch and bus.

Apparatus:

ETAP Software.

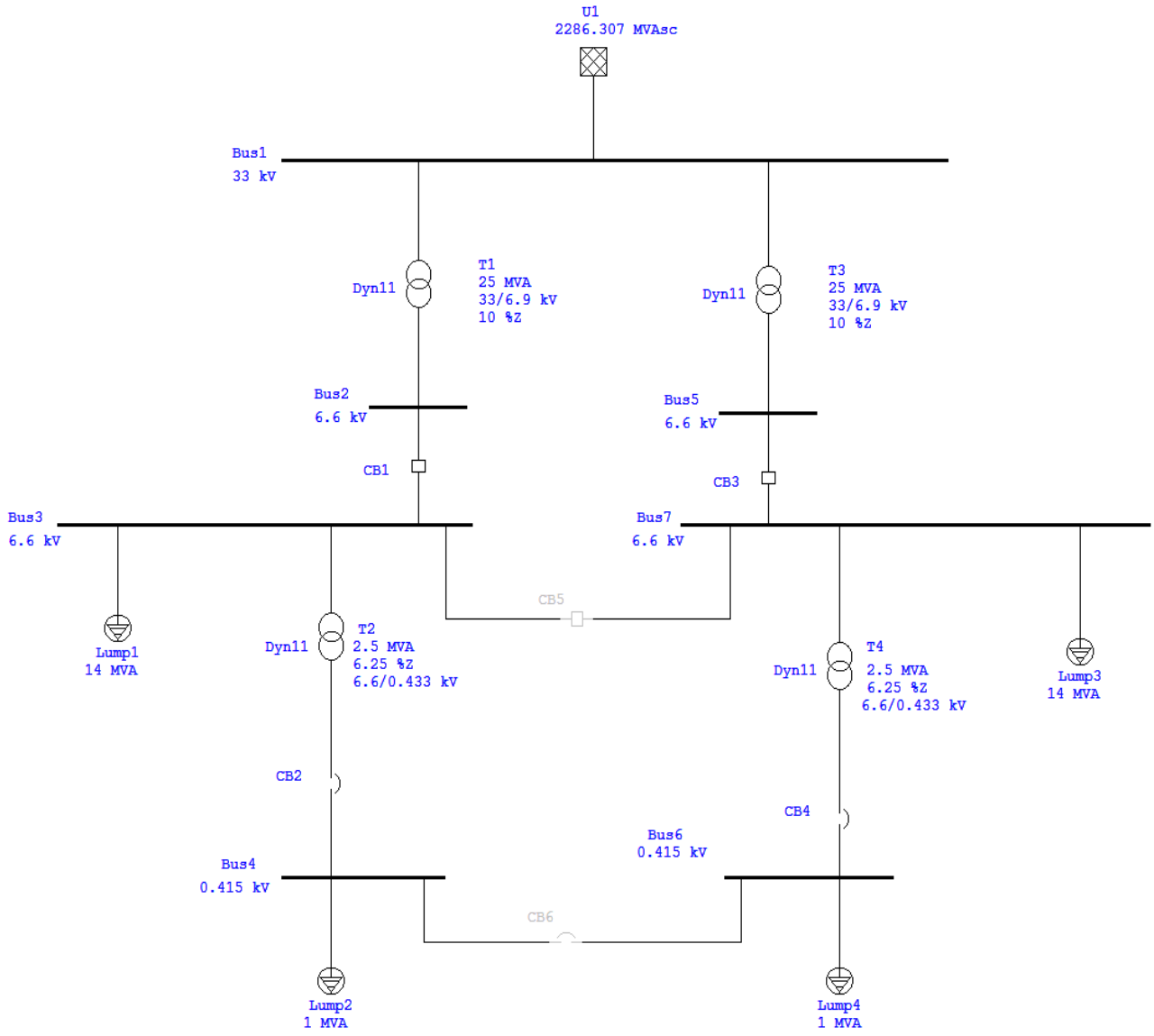
Personal computer.

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Load Flow Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

Circuit Diagram:



Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Load Flow Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

THEORY:

Power flow studies, commonly known as load flow, form an important part of power system analysis. They are necessary for planning, economic scheduling, and control of an existing system as well as planning its future expansion.

The aim of for conducting load flow analysis is to determine magnitudes and phase angle of voltages at each bus and also the active and reactive power flow in each line. In solving a power flow problem, the system is assumed to be operating under balanced conditions. Four quantities are associated with each bus. These are voltage magnitude, phase angle, real power and reactive power.

The system buses are generally classified into 3 types.

Slack bus : One bus , known as slack bus or swing bus, is taken as reference where the magnitude and phase of voltage are specified .This bus makes up the difference between the scheduled loads and the generated power that are caused by the losses in the network.

Load bus: At these buses the active and reactive power are specified. The magnitude and phase angle of the bus voltages are unknown. These buses are called P-Q buses.

Regulated bus or voltage controlled bus : These buses are the generator buses. They are known as voltage controlled buses. At these buses, the real and voltage magnitude are specified. The phase angle of the voltages and the reactive power are to be determined. The limits of the value of the reactive power are also specified. These buses are called as P-V buses.

Title: **Load Flow Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

Procedure:

Step 1: Build the single line diagram for load flow analysis.

Step 2: Input parameters for load flow analysis.

POWER GRID:

Nominal KV	= 33 SWING
KASc	= 40
X/R	= 14

TRANSFORMER 1:

Primary KV	= 33
Secondary KV	= 6.9
MVA	= 25
%Z and X/R	= 10 and 20

TRANSFORMER 2:

Primary KV	= 6.6
Secondary KV	= 0.433
MVA	= 2.5
%Z and X/R	= 6.25 and 6

TRANSFORMER 3:

Primary KV	= 33
Secondary KV	= 6.9
MVA	= 25
%Z and X/R	= 10 and 20

TRANSFORMER 4:

Primary KV	= 6.6
Secondary KV	= 0.433
MVA	= 2.5
%Z and X/R	= 6.25 and 6

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Load Flow Analysis by using ETAP** GPRECD/EEE/EXPT-PSP-9
Date: 10-1-2023

BUS 1:

Nominal KV = 33
Load diversity factor = min 80% and max 125%.

BUS 2:

Nominal KV = 6.6
Load diversity factor = min 80% and max 125%.

BUS 3:

Nominal KV = 6.6
Load diversity factor = min 80% and max 125%.

BUS 4:

Nominal KV = 0.415
Load diversity factor = min 80% and max 125%.

BUS 5:

Nominal KV = 6.6
Load diversity factor = min 80% and max 125%.

BUS 6:

Nominal KV = 0.415
Load diversity factor = min 80% and max 125%.

BUS 7:

Nominal KV = 6.6
Load diversity factor = min 80% and max 125%.

LUMPED LOAD 1:

MVA = 14
Nominal KV = 6.6
% PF = 85
AMP = 1225
Load type =100% KVA

LUMPED LOAD 2:

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Load Flow Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

MVA = 1
Nominal KV = 0.415
% PF = 80
AMP = 1391
Load type =100% KVA

LUMPED LOAD 3:

MVA = 14
Nominal KV = 6.6
% PF = 85
AMP = 1225
Load type =100% KVA

LUMPED LOAD 4:

MVA = 1
Nominal KV = 0.415
% PF = 80
AMP = 1391
Load type =100% KVA

Step 3: Run the load flow analysis by using ETAP software.

Result:

VIVA QUESTIONS:

1 What is the purpose served by the load flow analysis?.
2. What are the various types of buses used in load flow analysis?
3. What are quantities specified at a load bus?
4. What are quantities specified at a generator bus?
5. Define Swing bus?
6. Define bus admittance matrix?
7. What are the various methods to slove the load flow?
8. What are the advantages of NR method over GS method?
9. Which method for the solution of load flow the acceleration factor is used?
10. State Gauss-Seidel load flow formula?

Prepared by:
Dr.G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Short Circuit Analysis by using ETAP**	GPRECD/EEE/EXPT-PSP-9 Date: 10-1-2023

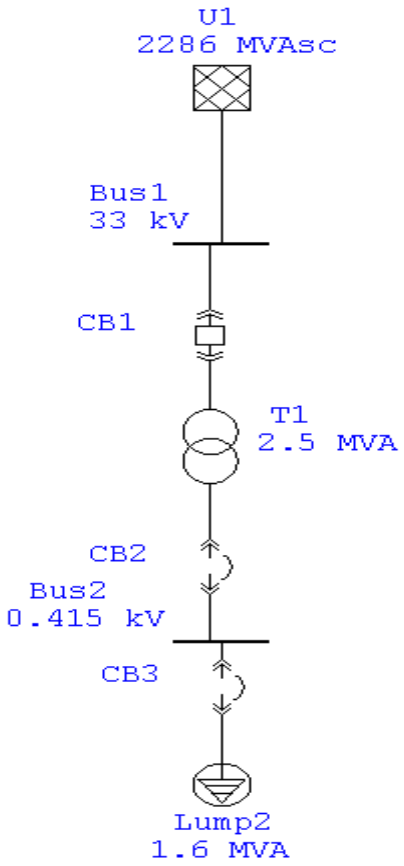
Aim: To study the short circuit analysis and to determine the symmetrical and asymmetrical fault current.

Apparatus:

ETAP Software

Personal computer

Circuit Diagram:



Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Short Circuit Analysis by using ETAP** GPRECD/EEE/EXPT-PSP-9
Date: 10-1-2023

THEORY:

Short circuit studies and hence the fault analysis are very important for the power system studies since they provide data such as voltages and currents during and after the various types of faults which are necessary in designing the protective schemes of the power system. Current that flows in the power system component just after the occurrence of faults that flows a few cycles later and the steady state value fault currents differ very much from each other.

They are different types of faults in the power system which can broadly be divided into symmetrical and unsymmetrical faults. The currents and voltages resulting from various types of faults occurring at different locations throughout the power system network must be calculated in order to provide sufficient data for designing the protective scheme.i.e, both the protective relays and circuit breakers

Different types of faults in power system are

(i) 3-phase direct short circuit or 3-phase fault through fault impedance (i.e., LLLG)

(ii) 1-phase to ground fault with and without fault impedance (LG)

(iii) Line to line direct short circuit or short circuit with fault impedance (LL)

(iv) Double line to ground fault with or without fault impedance (LLG)

Out of the four types of faults as listed above, the first one which is the least common but most severe is a symmetrical fault.i.e, after the fault, the system remains symmetrical.i.e., after the fault the voltages and currents become unbalanced, thus it becomes a case of balanced network with unbalanced excitation. In addition to the above, there may be several types of faults such as opening of one or two conductors etc.

Title: **Short Circuit Analysis by using ETAP** GPRECD/EEE/EXPT-PSP-9
Date: 10-1-2023

Procedure:

Step 1: Build the single line diagram for short circuit analysis.

Step 2: Input parameters for short circuit analysis.

POWER GRID:

Nominal KV = 33 SWING
KASc = 40
X/R = 14

TRANSFORMER 1:

Primary KV = 33
Secondary KV = 0.433
MVA = 2.5
%Z and X/R = 6.25 and 10.67

LUMPED LOAD 1:

MVA = 1.6
Nominal KV = 0.433

Step 3: Create fault at any bus.

Step 4: Run the Short circuit analysis by using ETAP software.

Result:

Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Short Circuit Analysis by using ETAP** GPRECD/EEE/EXPT-PSP-9
Date: 10-1-2023

VIVA QUESTIONS:

1 Define Short circuit KVA in terms of Base KVA?
2. What is meant by percentage reactance?
3. Which of the electrical quantities are chosen as base values?
4. Define per-unit value of any quantity?
5. What is the relationship between base KVA, base KV and percentage reactance?
6. Why the per-unit method is considered superior to percent method for Short-circuit calculations?
7. What do you understand about short-circuit? Discuss the possible causes of short circuit in the power system?
8. What is the importance of short-circuit calculations?
9. What are the possible faults on overhead lines?
10. Define the single line diagram?

Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Detection of harmonic currents and filter design using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

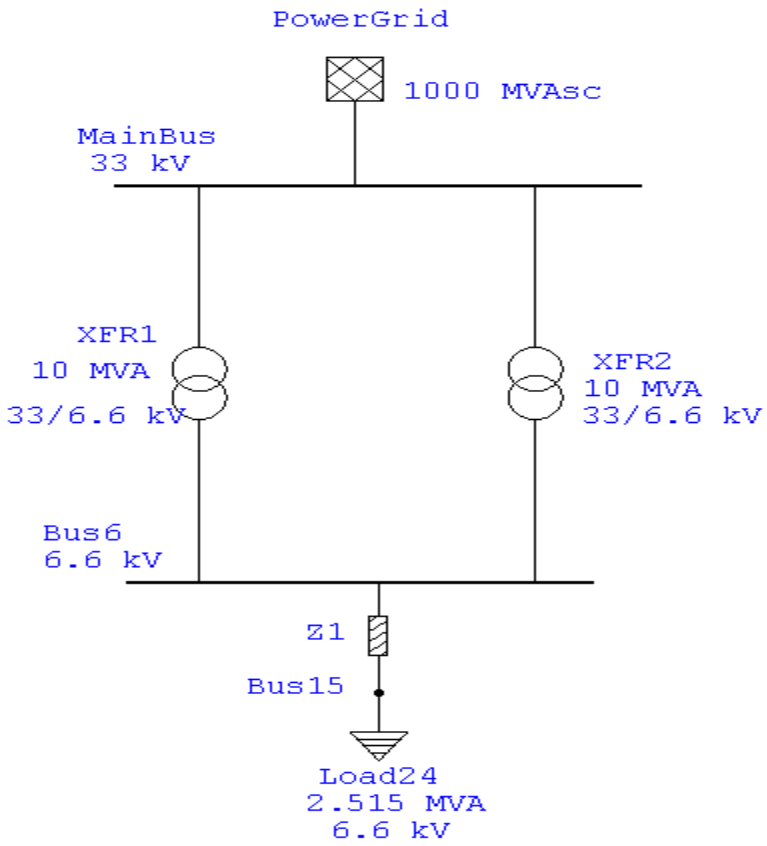
Aim: To study the harmonic analysis and to design the filters using etap.

Apparatus:

ETAP Software

Personal computer

Circuit Diagram:



Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Detection of harmonic currents and filter design using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

THEORY:

Power system study and analyses are significant parts of power system engineering. Delivering good quality power is one of the major purposes of any electrical service company. In recent times, power quality has been affected in the power network caused by increasing the use in amount of DC devices, non-linear loads.

Power system harmonics are one of the main causes for incorrect power quality. This has become a major issue and needs to be solved for power quality problems and harmonic analysis by analyzing the electric power network to minimize the harmonics distortion current or voltage. Power system harmonic analysis has been completed using ETAP software, and the entire process is explained in this project. ETAP software performs mathematical calculations of huge integrated power systems with magnificent speed as well, producing output reports. As a harmonic source a general load was demonstrated to inject harmonic current from side to side within the power network. Lastly, the Harmonic Load Flow analysis was implemented and harmonic distortion identified to investigate the outcome of harmonic current.

Title: **Detection of harmonic currents and filter design using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

Procedure:

Step 1: Build the one line diagram for harmonic analysis.

Step 2: Input data for Harmonic analysis.

Case 1 : Harmonic analysis Without Filter:

POWER GRID:

Nominal KV	= 33 SWING
Fault MVA	= 1000
KASc	= 999
X/R	= 40

TRANSFORMER 1:

Primary KV	= 33
Secondary KV	= 6.6
MVA	= 10
%Z	= 8.35

LUMPED LOAD (STATIC LOAD):

Nominal KV	= 6.6
Amps	= 220
% PF	= 80

Step 3**:** Run the harmonic load flow to find the harmonic current for different order.

Case 2 : Harmonic analysis With Filter:

Step 4**:** Add harmonic filter for the given circuit diagram.

Step 5**:** Run the harmonic load flow to find the harmonic current with filter.

Step 6**:** Compare the result for without and with filter.

Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Detection of harmonic currents and filter design using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

Result:

VIVA QUESTIONS:

1. Define harmonic component?
2. What is meant harmonic distortion?
3. Which meant by harmonic filter?
4. Define harmonic number?
5. What is meant by inter harmonic component?
6. What is meant by total demand distortion (TDD)?
7. What is meant by total harmonic distortion (THD)?
8. What is meant by harmonic resonance?
9. Define passive filter?
10. Define impulsive transient?

Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr. K. Sri Gowri
HOD, EEE Dept

Title: **Determination of Transient stability by using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

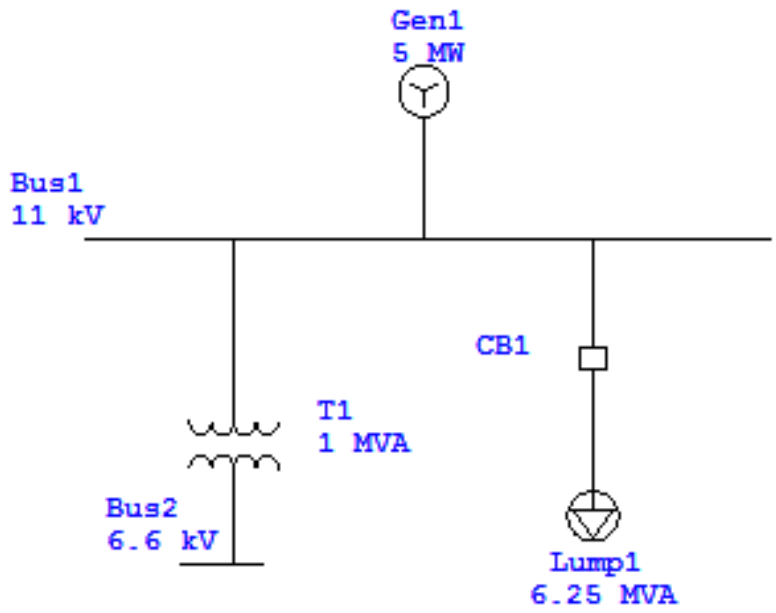
Aim: To study the system dynamic response and stability limits before, during and after the fault.

Apparatus:

ETAP Software

Personal computer

Circuit Diagram:



Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **Determination of Transient stability by using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

THEORY:

Power system stability is the property of power system that enables it to remains in a state of operating equilibrium under normal operating conditions and to regain an acceptable state of equilibrium after being subjected to a disturbance.

Transient stability is the ability of power system to maintain synchronism when subjected to a severe transient disturbance.

Steady state stability limit:

The steady state stability is defined as the stability of a system under conditions of gradual or small changes in the system. This stability can be either found by the load flow calculation for a steady state operation, or determined by a transient stability study if there are system changes or disturbances involved. The system is said to be steady state stable , if ,following any small and / gradual disturbances , all synchronous machines reach their steady state operating conditions identical or close to the pre disturbance operating conditions. The steady state stability limit for any synchronous machine is when the rotor angle less than 90^0.

Transient stability limit:

Transient stability is defined as the stability of a system during and after sudden changes or disturbances in the system, such as short circuits, loss of generators, sudden changes in load, line tripping, or any other similar impact. The system is said to be transient stable if following a severe disturbance, all synchronous machines reach their steady-state operating condition without prolonged loss of synchronism or going out of step with other machines.

Title: **Determination of Transient stability by using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

Procedure:

Step 1: Build the single line diagram for transient stability analysis.

Step 2: Input parameters for transient stability analysis.

GENERATOR (TYPICAL I/P MODEL- SUBTRANSIENT MODEL):

Nominal KV	= 11 KV
MW	= 5
%PF	= 80
% Efficiency	= 97
H	= 2.5 MW-SEC/MVA
Exciter Model	= AC8B
Governor Model	= GP

TRANSFORMER 1 (DYn11):

Primary KV	= 11
Secondary KV	= 6.6
MVA	= 1
%Z and X/R	= Typical values

LUMPED LOAD 1:

MVA	= 6.25
%LRC	= 650
% PF	= 80
%LF	= 100
Load type	=100% KVA

Step 3: To study load application on single generator, initially open CB1 connected to Load.

Step 4: Create a new study case as ‘LA’

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **Determination of Transient stability by using ETAP**	GPRECD/EEE/EXPT-PSP-10 Date: 10-1-2023

Step 5: Go to events page and add on event to close CB1 at 1 sec.

Step 6: Go to plot page, Select generator 1 in synchronous generator and bus1 in buses.

Step 7: Run transient stability with output report name 'Load Application'.

Step 8: Go to transient stability plots, select generator1 in device ID and check for generator electrical power and mechanical power plots.

Step 9: Also check for generator1 voltage, bus1 voltage, and bus1 frequency Plots individually.

Result:

VIVA QUESTIONS:

1 Define transient stability?.
1. 2. What is meant by power angle curve?
2. Define infinite bus in a power system?
3. Write Swing equation for a single machine system?
4. What is equal area criterion?
5. Write down the units of inertia constants M and H and their inter-relationships?
6. Distinguish between steady state stability and transient stability of a power system?
7. What is the power angle equation?
8. What are the applications of equal area criterion?
9. What are the various techniques for improving transient stability?

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **OPTIMAL POWER FLOW USING ETAP**	GPRECD/EEE/EXPT-PSP-11 Date: 10-1-2023

Aim: To study the optimal power flow analysis and to determine Real and Reactive power across each branch and bus.

Apparatus:

ETAP Software

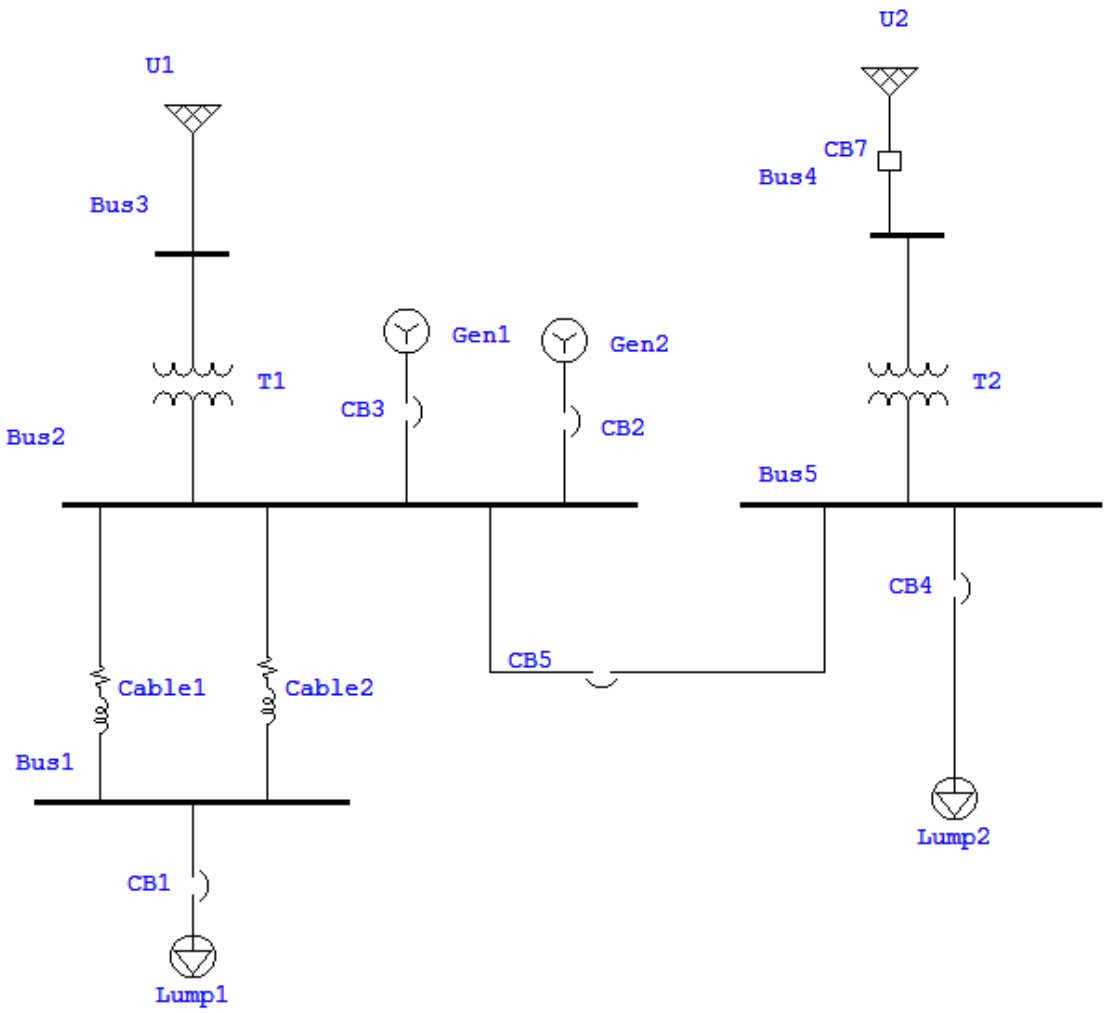
Personal computer

Prepared by:
Dr. G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **OPTIMAL POWER FLOW USING ETAP**	GPRECD/EEE/EXPT-PSP-11 Date: 10-1-2023

Circuit diagram:



Prepared by:
Dr. G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **OPTIMAL POWER FLOW USING ETAP** GPRECD/EEE/EXPT-PSP-11
Date: 10-1-2023

THEORY:

In an optimal power flow, the values of some or all of the control variables need to be found so as to optimize (minimize or maximize) a predefined objective. It is also important that the proper problem definition with clearly stated objectives be given at the onset. The quality of the solution depends on the accuracy of the model studied. Objectives must be modeled and its practicality with possible solutions. Objective function takes various forms such as fuel cost, transmission losses and reactive source allocation. This is most used as it reflects current economic dispatch practice and importantly cost related aspect is always ranked high among operational requirements in Power Systems.

OPF aims to optimize a certain objective, subject to the network power flow equations and system and equipment operating limits. The optimal condition is attained by adjusting the available controls to minimize an objective function subject to specified operating and security requirements. Some well-known objectives can be identified as below:
Active power objectives

1. Economic dispatch (minimum cost, losses, MW generation or transmission losses)
2. Environmental dispatch
3. Maximum power transfer.

Reactive power objectives MW and MVAr loss minimization General goals

1. Minimum deviation from a target schedule
2. Minimum control shifts to alleviate Violations
3. Least absolute shift approximation of control shift

Among the above the following objectives are most commonly used: (a) Fuel or active power cost optimization (b) Active power loss minimization 40 (c) VAR planning to minimize the cost of reactive power support.

Title: **OPTIMAL POWER FLOW USING ETAP**	GPRECD/EEE/EXPT-PSP-11 Date: 10-1-2023

Procedure:

Step 1: Build the single line diagram for optimal power flow analysis.

Step 2: Input parameters for optimal power flow analysis.

POWER GRID 1:

Nominal KV = 13.8 SWING
MVAsc = 50
KASc = 2.092
X/R = 8

POWER GRID 2:

Nominal KV = 13.8 SWING
MVAsc = 50
KASc = 2.092
X/R = 8

GENERATOR 1:

Nominal KV = 4.16 (VOLTAGE CONTROL)
MVA = 23.529
%PF = 85
% EFFICIENCY = 95

GENERATOR 2:

Nominal KV = 4.16 (VOLTAGE CONTROL)
MVA = 23.529
%PF = 85
% EFFICIENCY = 95

TRANSFORMER 1:

Primary KV = 13.8
Secondary KV = 4.16

Prepared by:
Dr. G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

Title: **OPTIMAL POWER FLOW USING ETAP** GPRECD/EEE/EXPT-PSP-11
Date: 10-1-2023

MVA = 15
%Z and X/R = 6.5 and 18.6 (typical values)

TRANSFORMER 2:

Primary KV = 13.8
Secondary KV = 4
MVA = 15
%Z and X/R = 6.5 and 18.6 (typical values)

CABLE 1:

Model = 3/C CU 6 EPR 5 KV
Length = 100 ft

CABLE 2:

Model = 3/C CU 6 EPR 5 KV
Length = 100 ft

BUS 1:

Nominal KV = 4.16
Load diversity factor = min 80% and max 125%.

BUS 2:

Nominal KV = 4.16
Load diversity factor = min 80% and max 125%.

BUS 3:

Nominal KV = 13.8
Load diversity factor = min 80% and max 125%.

BUS 4:

Nominal KV = 13.8
Load diversity factor = min 80% and max 125%.

Title: **OPTIMAL POWER FLOW USING ETAP** GPRECD/EEE/EXPT-PSP-11
Date: 10-1-2023

BUS 5:

Nominal KV = 4
Load diversity factor = min 80% and max 125%.

LUMPED LOAD 1:

MVA = 8
Nominal KV = 4.16
% PF = 85
AMP = 1110
Load type = 80% Constant KVA & 20 % Constant Z

LUMPED LOAD 2:

MVA = 8
Nominal KV = 4
% PF = 85
AMP = 1115
Load type = 80% Constant KVA & 20 % Constant Z

Step 3: Run the optimal power flow analysis by using ETAP software.

Result:

Viva Questions:

1. What is meant by load flow analysis?
2. What is meant by Economic Load Dispatch?
3. What is meant by optimal power flow?
4. What is meant by active power and reactive power?
5. What are the main objectives of optimal power flow method?
6. What is the total Generation cost function?
7. Explain the condition for economic load dispatch without losses?
8. Explain the condition for economic load dispatch with losses?
9. What is meant by Lagrange multiplier.?
10. Define penalty factor?

Prepared by:
Dr. G.Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SEQUENCE IMPEDANCES OF 3-PHASE TRANSFORMER**	GPRECD/EEE/EXPT-PSP-12 Date: 10-1-2023

AIM:

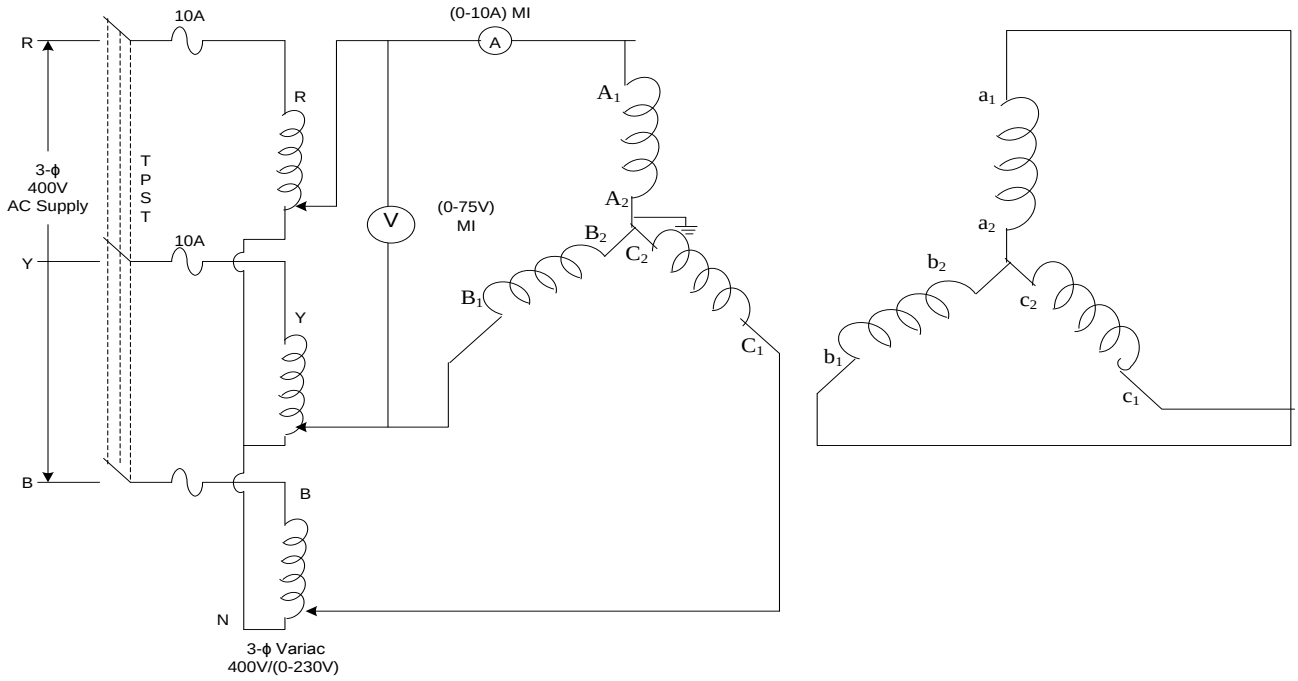
To determine positive, negative, Zero sequence reactance's of a 3 - ϕ Transformer.

APPARATUS:

1 - ϕ Auto Transformer	(230/0 – 270V, 10A)		1
3 - ϕ Auto Transformer	(400/0-470V, 10A)		1
Voltmeter	(0 – 75V) & (0 – 300V)	MI	1
Ammeter	(0 – 10A)	MI	1
Connecting wires			required number

CIRCUIT DIAGRAM:

Positive & Negative sequence diagram

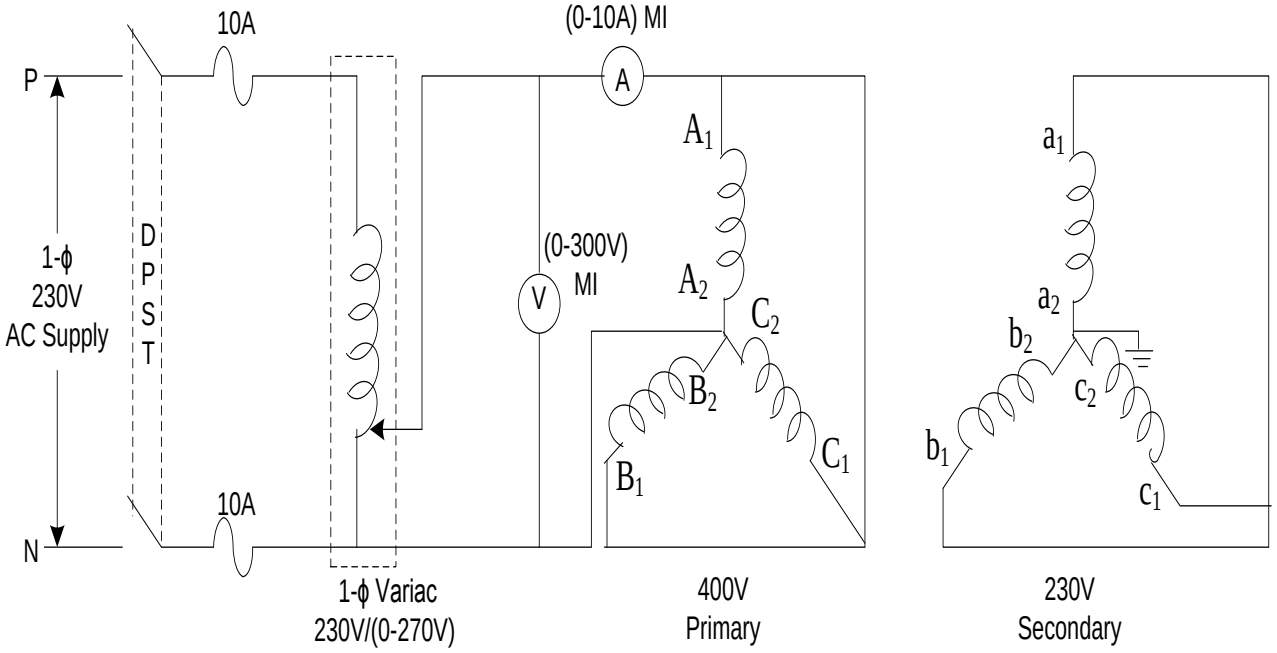


Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SEQUENCE IMPEDANCES OF 3-PHASE TRANSFORMER** GPRECD/EEE/EXPT-PSP-12 Date: 10-1-2023

Zero sequence diagram



THEORY:

Each element of power system will offer impedance to different phase sequence components of current which may not be same. In unsymmetrical fault calculations, each piece of equipment will have three values of impedance – one corresponding to each sequence current .i.e Positive sequence impedance(Z_1) ,Negative sequence impedance(Z_2) , Zero sequence impedance(Z_0).

The impedance offered by the equipment or circuit to positive sequence current is called positive sequence impedance and is represented by Z_1.Similarly, impedances offered by any circuit or equipment to negative and zero sequence currents are respectively called negative sequence impedance (Z_2), and zero sequence impedance(Z_0).

The positive and negative sequence impedance of a Transformer are equal.This value being equal to the impedance of transformer.However zero sequence impedance depends upon earth connection.If there is a through circuit for earth current,zero sequence impedance will be equal to positive sequence impedance otherwise it will be infinite.

TITLE: **SEQUENCE IMPEDANCES OF 3-PHASE TRANSFORMER** GPRECD/EEE/EXPT-PSP-12 Date: 10-1-2023

PROCEDURE:

POSITIVE AND NEGETIVE SEQUENCE IMPEDANCE:-

1. Connect the circuit as shown in figure.
2. TPST was closed and the voltage was applied in steps by using 3 phase Variac.
3. Note down the readings of Ammeter, Voltmeter for different applied voltages. Using these readings calculate positive sequence impedances.

ZERO SEQUENCE IMPEDANCE:-

1. Connect the circuit as shown in figure.
2. DPST switch was closed and applied voltage was gradually increased with the help of 1 - ϕ variac.
3. Note down the readings of Voltmeter and Ammeter for different applied voltages.
4. From these readings calculate the zero sequence impedance.

TABLE:

FOR POSITIVE SEQUENCE:

VOLTAGE	CURRENT	$Z_1=(V/\sqrt{3})/I$

ZERO SEQUENCE:-

VOLTAGE	CURRENT	$Z_0=(3V)/I$

NEGATIVE SEQUENCE:-

VOLTAGE	CURRENT	$Z_2=(V/\sqrt{3})/I$

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **SEQUENCE IMPEDANCES OF 3-PHASE TRANSFORMER**	GPRECD/EEE/EXPT-PSP-12 Date: 10-1-2023

RESULT:

VIVA QUESTIONS:

1. Define the positive, negative & zero sequence impedance?
2. Draw the zero sequence network for Δ -Δ connected transformers?
3. What are the relation between positive, negative & zero sequence impedances of transformer?
4. Draw the zero sequence network for Star with neutral grounding - Star with neutral grounding connected transformers?
5. Draw the zero sequence network for Star with neutral grounding - delta connected transformers?
6. What is the difference between 3-phase transformer and Auto transformer?
7. What are the various losses occur in a transformer?
8. Draw the zero sequence networks for Star – Star connected transformers?

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **MEASUREMNT OF EARTH RESISTANCE** GPRECD/EEE/EXPT-PSP-13
Date: 10-1-2023

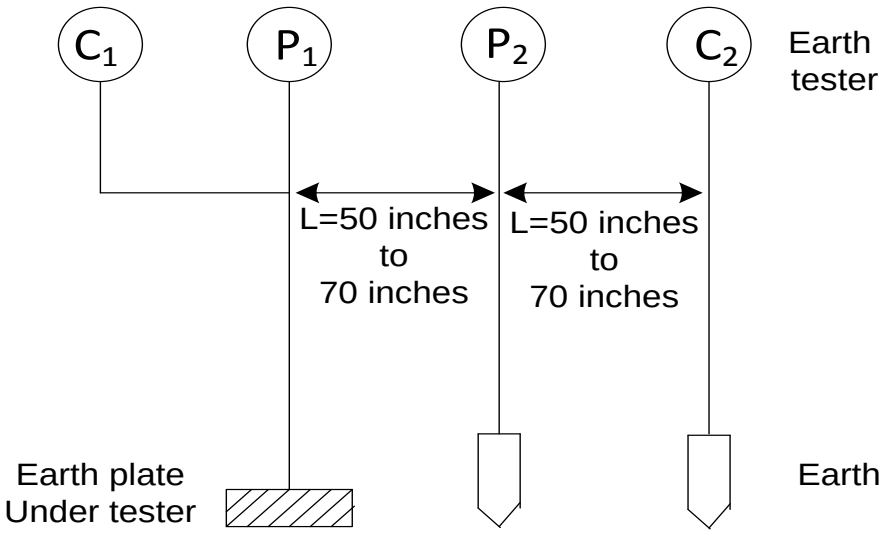
AIM: To measure the value of earth resistance.

APPARATUS:

Four terminal earth Tester	IEM type	1
Hand operator,		
Spikes		2
Hammer		1
Lengthy cable leads		2
Plier		1
Screw		1

NAME PALTE DETAILS:

CIRCUIT DIAGRAM:



Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **MEASUREMNT OF EARTH RESISTANCE** GPRECD/EEE/EXPT-PSP-13
Date: 10-1-2023

THEORY:

All parts of electrical equipment, like caring of machines,switches & circuit breakers, lead sheathing of cable, tanks of transformers etc which have to be at earth potential must be connected to earth electrode. The purpose of this is to protect the various parts of installations,as well as the persons working against damage in case the installation of system faults at any point.By connecting the points to an earthed electrode a continuous low resistance path is available for leakage currents to flow to earth. This current operates the protective devices & thus the faulty circuit is isolated in case a fault occurs.The earth electrode causes that in the event of overvoltage on the system due to lighting discharges on other system faults, those parts of equipment wheels are normally dead as far as voltages are connected do not attain dangerous high potentials.

PROCEDURE:

1. In the four terminals, the C1 and P1 were shorted.
2. The earth plate and two spikes are connected as shown in the figure.
3. Rotate the handle of the generator till the pointer comes to rest.
4. Note down the value of resistor directly in ohms.

TABLE:

SNO	PLACE	RESISTANCE

RESULT:

VIVA QUESTIONS:

1. What is meant by earthing?
2. How is earthing achieved?
3. What is meant by potential gradient?
4. How is measurement of earth resistance carried out by earth tester?
5. What is meant by arcing ground?
6. What is difference between system earthing and equipment earthing?
7. On what factor does the resistivity of soil depend?
8. What is meant by an earth electrode?
9. Give the maximum permissible values of ground resistance for (a) large power station and (b) small substation?
10. What is average resistance of a human body?

Prepared by:
Dr. G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

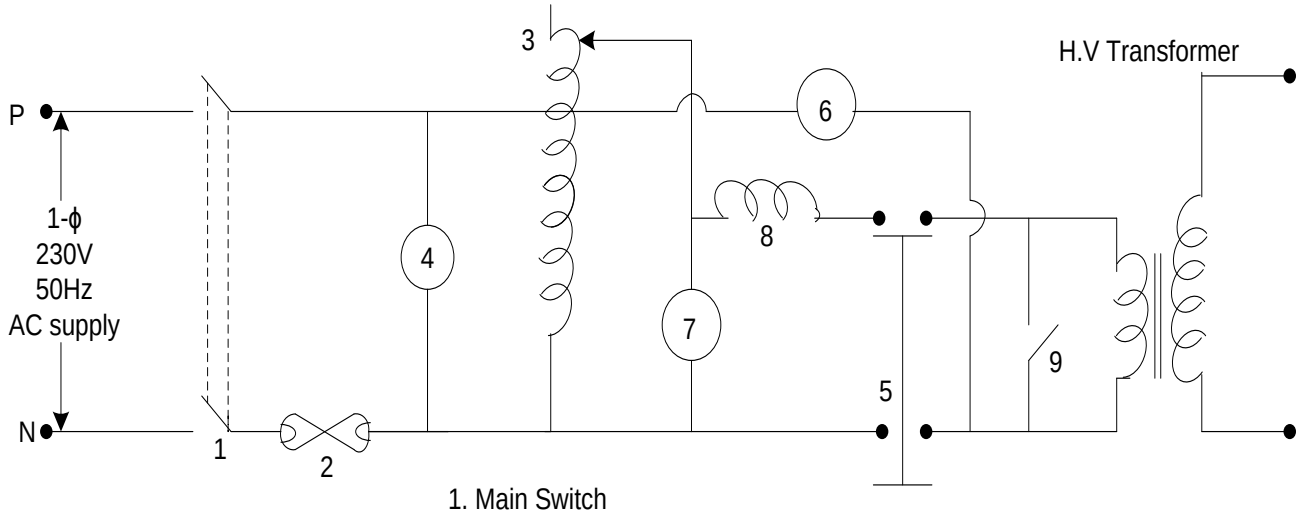
TITLE: **STUD Y OF OIL TESTING KIT AND DETERMINATION OF DIELECTRIC STRENGTH OF TRANSFORMER OIL** GPRECD/EEE/EXPT-PSP-14 Date: 10-1-2023

AIM: To test the breakdown strength of Transformer oil.

APPARATUS:

1. Transformer oil test kit
2. Transformer oil
3. Keys for gap measuring

CIRCUIT DIAGRAM:



1. Main Switch
2. Fuse
3. Voltage Regulator
4. Mains Indicator
5. Over Load Switch
6. Trip Voltage Indicator
7. Voltmeter
8. Trip Coil
9. Interlock Switch

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **STUD Y OF OIL TESTING KIT AND DETERMINATION OF DIELECTRIC STRENGTH OF TRANSFORMER OIL** GPRECD/EEE/EXPT-PSP-14 Date: 10-1-2023

THEORY:

When testing oils, the set is operated according to a particular method i.e., with a fixed spark gap and variable testing voltages. The voltage should be increased gradually under continuous observation of the measuring instrument until the break down occurs. To test oil of high quality the distance between electrodes should be adjusted to 2.5mm for testing oils of medium quality or inferior quality the gap adjusted to 4mm by means of distance gauge. The oil testing cup is equipped normally with two electrodes of 36mm dia radius of each in 285mm. The oil-testing cup is kept as small as possible to do with minimum quality of oil 400ml suitable safety contacts are provided to put the setout of operation as soon as the top lid is opened in order to insert or remove the test cup. Thus eliminating HT danger the set is disconnected automatically as soon as the puncture occurs. No oil tests are possible as long as the lid of the rear of the cabinet is open, the test must be carried out six times on the same cell filing.

The first application of the voltage is made as quickly as possible after cell has been filled, provided there are no longer 'AIR BUBBLES' in the oil and at the latest ten minutes after filling.Aftereach breakdown the oil is gently stirred between the electrodes by means of a clean dry glass rod avoiding as far as possible the production of air bubbles. For the subsequent five tests, the voltage is reapplied one minute after the disappearance of air bubbles is not possible it is necessary to wait five minutes before a new breakdown tests is started. The electric strength shall be the arithmetic mean of the six results, which have been obtained

PROCEDURE:

1. Set the gap between the electrodes using iron plate to 2.5mm.
2. Make sure that there are no air bubbles on the surface of the oil present in the chamber..
3. Switch on the test kit.
4. Slowly raise the voltage till there is a breakdown and record the breakdown voltage.
5. Bring the voltage down to zero.
6. Remove the suspended particles due to breakdown with the help of glass tube provided.
7. Wait for 5 minutes.
8. Repeat steps 3 to 6, five times given a total of six observations.
9. Switch off the test kit.

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

TITLE: **STUD Y OF OIL TESTING KIT AND DETERMINATION OF DIELECTRIC STRENGTH OF TRANSFORMER OIL** GPRECD/EEE/EXPT-PSP-14 Date: 10-1-2023

OBSERVATIONS:

S.NO	BREAKDOWN VOLTAGE	
	Distance between electrodes = 2.5mm	Distance between electrodes = 4 mm
1.		
2.		
3.		
4.		
5.		
6.		
Average B.V =		

RESULT:

BREAKDOWN VOLTAGE	
Distance between electrodes = 2.5mm	Distance between electrodes = 4 mm

VIVA QUESTIONS:

1 Define the dielectric stress?
2. What is the value dielectric strength of air?
3. What are the units for dielectric strength?
4. What are the types of transformer oil?
5. What are the properties of transformer oil?
6. What are the electrical parameters of transformer oil?
7. What are the chemical parameters of transformer oil?
8. What are the physical parameters of transformer oil?
9. What is meant by specific resistance of oil
10. What is the minimum standard value of specific resistance of transformer oil at 27^0 C.

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K.Sri Gowri
HOD, EEE Dept

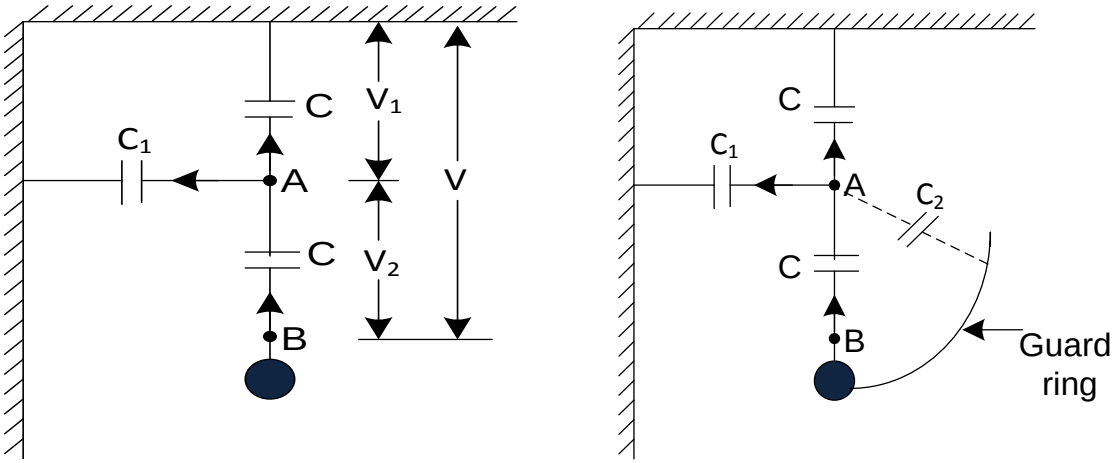
TITLE: **Simulation of String Insulators for determination of Voltage distribution and String efficiency.**	GPRECD/EEE/EXPT-PSP-15 Date: 10-1-2023

AIM: To determine voltage distribution and the string efficiency of suspension insulator with and without guard ring

APPARATUS:

Experiment board		1
1-phase Auto transformer	230V/(0-270V)	1
Multimeter		1
Capacitors	1 µf , 0.1 µf, 0.22 µf.	each one
Connecting wires		required number

CIRCUIT DIAGRAM:



Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Simulation of String Insulators for determination of Voltage distribution and String efficiency.**	GPRECD/EEE/EXPT-PSP-15 Date: 10-1-2023

THEORTITICAL CALCULATIONS:

$K = C_1/C$ Where C = Self capacitance and C_1 = Shunt capacitance

Without Guard Ring:

$V_1 = V_2/(1+K) = V/(2+K)$;

String efficiency = $V/2*V_2$

THEORY:

The potential distribution in a String of Suspension insulator is not uniform. The maximum voltage appears across the insulator nearest to the line conductor and decreases progressively as the cross arm is approached. If the insulation of the highest Stressed insulator(i.e nearest to conductor) breaks down or flash over takes place, the breakdown of other units will take place in succession. This necessitates to equalize the potential across the various units of the String, i.e to improve the String efficency.The various methods for this purpose are;

(1) **By using longer Cross-arm**:-The value of String efficiency depends upon the value of K, i.e ratio of Shunt capacitance to mutual capacitance. The lesser the value of K,greater is the String efficiency and more uniform is the voltage distribution.

(2) **By grading the insulator**:- In this method, insulators of different dimensions are so chosen that each has a different capacitance. The insulator are capacitance graded i.e. they are assembled in the String in such a way that the top Unit has minimum capacitance,increasing progressively as the bottom Unit (i.e.nearest to conductor) is reached.Since voltage is inversely proportional to capacitance,this method tends to equalize the potential distribution across the units in String.

(3) **By using a guard ring** – The potential across each unit in a String can be equalized by using a guard ring which is a metal ring electrically connected to conductor and surrounding the bottom insulator. The guard ring introduces capacitance between metal fitting and line conductor.The guard ring is connected in

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Simulation of String Insulators for determination of Voltage distribution and String efficiency.** GPRECD/EEE/EXPT-PSP-15 Date: 10-1-2023

such a way that Shunt capacitance currents are equal to metal fitting line capacitance currents. The result is that the same charging current I flows through each unit of String.Cosequently, there will be uniform potential distribution across the units.

PROCEDURE:

1. Connect the circuit as shown in the diagram.
2. Apply voltage less than 100V across the series string.
3. Measure the voltage across each string with multimeter (i.e V_1 and V_2).
4. Calculate the string efficiency without guard ring.
5. Repeat the procedure 1 to 4 with guard ring.
6. Verify the results theoretically.

TABLES:

Without Guard ring:

SNO	V	V_1	V_2	% η

With Guard ring:

SNO	V	V_1	V_2	% η

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept

TITLE: **Simulation of String Insulators for determination of Voltage distribution and String efficiency.**	GPRECD/EEE/EXPT-PSP-15 Date: 10-1-2023

RESULT:

	Theoretical	Practical
String efficiency without guard ring		
String efficiency with guard ring		

Viva Questions:

1. Why insulators used in overhead lines? Discuss the desirable properties of insulators?
2. What are the advantages and disadvantages of (*i*) pin-type insulators (*ii*) suspension type insulators.
3. What is strain insulator and where is it used?
4. Give the reasons for unequal potential distribution over a string of suspension insulators?
5. Define and explain string efficiency. Is its value be equal to 100% ?
6. What are the various methods of improving string efficiency?
7. What are the causes for the failure of overhead line insulators?
8. Write the different types of insulators used in transmission and distribution system?
9. String efficiency for a DC system is 100%? Explain.
10. Why are suspension insulators preferred for high voltage power transmission?

Prepared by:
Dr.G. Sreenivasa Reddy
Associate Professor

Approved by:
Dr.K. Sri Gowri
HOD, EEE Dept