MAHARASHTRA STATE
BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Mr. / Ms. KRISH PARAG SHAH Roll No. 05, of First Semester of Diploma in AUTOMATION AND ROBOTICS ENGINEERING of Institute, V.E.S. POLYTECHNIC. (Code: 004) has completed the term work satisfactorily in Subject **Elements of Electrical Engineering (22215)** for the academic year 20.20 to 20.21 as prescribed in the curriculum.

Place: CHEMBUR, MUMBAI

Enrollment No: 2000040109

Date: 17-06-21

Exam. Seat No: 102269

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

Content Page

List of Practicals and Progressive Assessment Sheet

S. No.	Title of the practical	Page No.	Date of performance	Date of submission	Assessment marks(10)	Dated sign. of teacher	Remarks (if any)
1.	Determine the permeability of magnetic material by plotting its B- H curve.	1	06-04-21	27-04-21	23	27-04-21	
2.	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part I	5	20-04-21	27-04-21	23	27-04-21	
3.	Determine frequency, time period, peak value, rms value, peak factor and form factor of a sinusoidal A.C. waveform on C.R.O. Part II	10	20-04-21	27-04-21	22	27-04-21	
4.	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part I	15					
5.	Find the phase difference between voltage and current on C.R.O. for resistive, inductive and capacitive circuits. Part II	20					
6.	Connect balanced star and delta load connections to get the required voltage and currents. Part I	25	27-04-21	18-05-21	23	18-5-21	
7.	Connect balanced star and delta load connections to get the required voltage and currents. Part II	30	04-05-21	18-05-21	23	18-5-21	
8.	Determine voltage and current ratio of single phase transformer.	35	11-05-21	18-05-21	22	18-5-21	
9.	Operate the DC shunt motor using 3-point starter.	40	18-05-21	25-05-21	24	25-5-21	
10.	Operate the DC shunt motor using 4-point starter.	45	18-05-21	25-05-21	22	25-5-21	
11.	Reverse the direction of rotation of single phase induction motor.	50	25-05-21	01-06-21	23	1-6-21	

S. No.	Title of the practical	Page No.	Date of performance	Date of submission	Assessment marks(10)	Dated sign. of teacher	Remarks (if any)
12.	Reverse the direction of rotation of Universal motor.	55	25-05-21	01-06-21	23	1-06-21	
13.	Identify switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB. Part I	60					
14.	Identify switches, fuses, switch fuse and fuse switch units, MCB, MCCB and ELCB. Part II	65					
15.	Test circuit using series lamp and multimeter.	70	01-06-21	08-06-21	24	8-06-21	
16.	Use the earth tester.	75					
17.	Use the insulation tester.	80					
18.	Use different types of digital clamp-on meters	86	01-06-21	08-06-21	24	8-06-21	
	Total Marks						

- To be transferred to proforma of CIAAN-2017.

Practical No. 01: Determine the permeability of magnetic material by Plottingits B-H curve.

I Practical Significance

B-H curve is necessary to calculate permeability of magnetic materials. B-H curve is different for different magnetic materials, used in various electrical equipments.

II Relevant Program Outcomes (POs)

PO1- **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems.
PO3- **Experiments and practice:** Plan to perform experiments and practices to use the Results to solve broad-based interdisciplinary engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use electrical equipments in industrial applications'***
1.Identify different types of magnetic materials.
2.Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use principles of magnetic circuits.

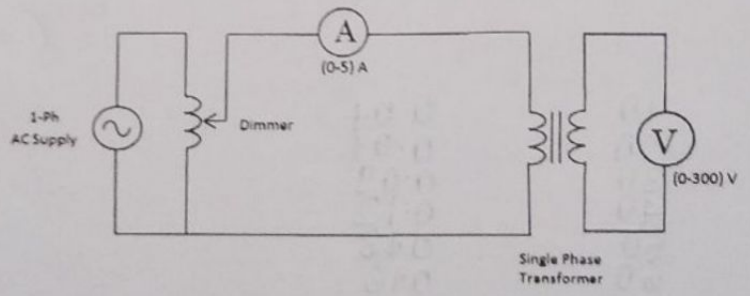
V Practical Outcome

Use magnetic material to:
i. Plot the B-H curve.
ii. Calculate permeability of the material.

VI Minimum Theoretical Background

Magnetization Curve: The non-linear relation between flux density (B) and magnetic field strength (H) for the magnetic material is known as magnetization curve (B-H curve).
Absolute permeability: The relationship is expressed as $B = \mu H$, where μ is called as absolute permeability of magnetic material.
In this experiment measured current is proportional to H and measured voltage is proportional to B.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-300V	1 No.
2	Voltmeter	0-300voltage	1 No.
3	Ammeter	0-1 A	1 No.
4	Single Phase Transformer	1 kVA, 230/115V	1 No.

IX Precautions to be Followed

1. Avoid loose connections
2. Don't touch wire with wet hand.

X Procedure

1. Select the Single Phase Transformer.
2. Select the relevant voltmeter, ammeter.
3. Connect the circuit as per circuit diagram.
4. Vary the dimmer, measure the current and voltage.
5. Plot B-H curve and calculate permeability by drawing tangent to linear portion of the curve.

XI Resources Used

S. No	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1.	Supple Supply		Ampere = 0-1A Voltage 0-300V	01	
2.	Voltmeter		0-300 Voltage	01	
3.	Ammeter		0-01 Ampere	01	
4.	Supple Phase Transformer		1KVA, 230/115V	01	

XII Actual Procedure Followed

1) Connect the devices as per circuit diagram 2) Vary the input supply and observe the value as input current and output supply voltage.

XIII Precautions Followed

1) Avoid loose connections
2) Don't touch with wet hands.

XIV Observations and Calculations

S.No.	Voltage (V) (volt)	Current(I)(ampere)
1	10	0.04
2	20	0.07
3	30	0.09
4	40	0.12
5	50	0.13
6	60	0.15
7	70	0.17
8	80	0.18
9	90	0.20

B: measured value as Volt H = 80 - 80
H: measured value as Ampere = 0.2 - 0.18

XV **Results**
Value of permeability = $B = \mu H \therefore \mu = \frac{B}{H} = \frac{10}{0.002} = 500$

XVI **Interpretation of Results** (Giving meaning to the results)

BH curve is plotted and it is found that the slope of BH curve is proportional to permeability (μ)

XVII **Conclusions**(Actions to be taken based on the interpretations)

Perform the BH curve of the magnetic materials of transformer that silicon steel.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. Which of the following are magnetic materials
   Copper, Silicon-Steel, Mica, Cobalt, Aluminum, Nickel, Wood.
2. Write the relation between B and H and also between other quantities like flux, MMF, ampere turns, voltage induced E, Current I.
3. Draw B-H curve for nonmagnetic material.
4. Draw hysteresis loop for magnetic material. Mark all parameters.

[Space for Answer]

Answer 1) Magnetic Materials: Silicon Steel, cobalt, Nickel.

Answer 2) Formula Symbol Physical quantity Units:
B magnetic field, Magnetic flux density, Induction tesla = weber per square metre.
C electric capacitance farad.
D electric flux density coloumb per square metre
E electric field strength volt meter.

Answer 3)

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (15 Marks)		**60%**	
1	Handling of the instrument	20%	
2	Determination of current and voltage	40%	
Product Related (10 Marks)		**40%**	
3	Plot B-H curve and interpretation of result	20%	
4	Conclusion	10%	
5	Practical related questions	10%	
	Total (25 Marks)	**100 %**	

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	9	23	

Practical No.02: Determine frequency, time period, peak value, rms value of a Sinusoidal A.C. waveform on CRO. Part I.

I Practical Significance

An alternating ac waveform is one that varies in both magnitude and direction in more or less an even manner with respect to time. An AC function can mathematically represent either a power source or a signal source with the shape of an *AC waveform*.

II Relevant Program Outcomes (POs)

PO1- Basic knowledge- Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems

PO3- Experiments and practice- Plan to perform experiments and practices to use the results to solve broad-based interdisciplinary engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **'Use electrical equipment in industrial applications'.**

i. Measure electrical quantities.
ii. Circuit connection.
iii. Follow safe practices.

IV Relevant Course Outcomes

Use single phase AC supply for electrical and electronic equipment.

V Practical Outcome

Determine frequency, time period, peak value, rms value of a sinusoidal A.C. waveform by observing it on C.R.O.

VI Minimum Theoretical Background

AC Waveform Characteristics:

• The Time period, (T)–

Time taken in seconds by an alternating quantity to complete one cycle is called time period. It is denoted by 'T' seconds.

• The Frequency, (*f*)

The number of cycles completed in one second is called frequency. It is denoted by 'f'(Hz).

$$f=1/T$$

• The Amplitude (A)

It is the magnitude or intensity of the signal waveform measured in volts or amps.

Average value

The average value of alternating quantity is equal to the average of all the instantaneous values over a period of half cycle.

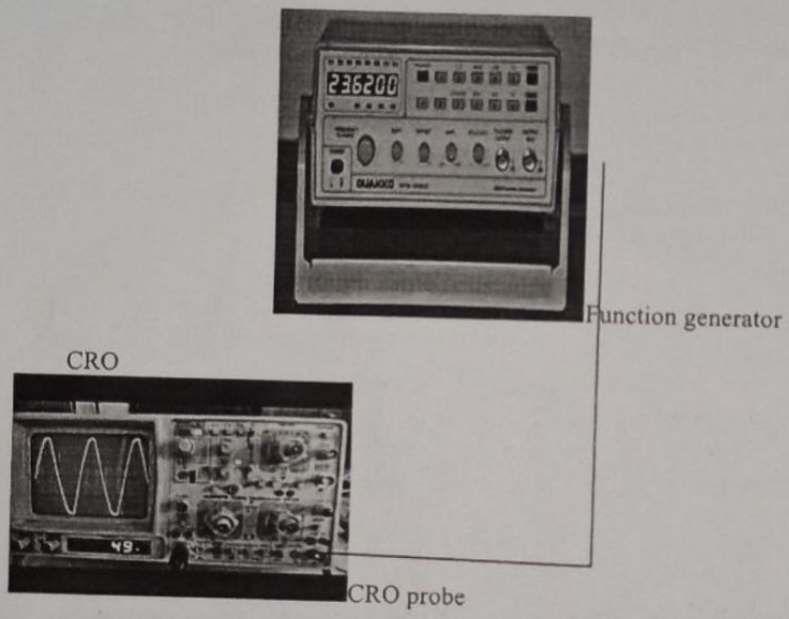
$V_{avg}=0.637V_{max}$

RMS value

The R.M.S value is equivalent value of current which produced same amount of heat as that value of dc current through same resistance for the same time.

$V_{rms}=0.707V_{max}$

VII Circuit diagram



VIII Resources required

S. No.	Name of Instrument	Specifications	Quantity	Remarks
1	CRO with probe	10Hz-30MHz	01	
2	Function generator	0.1 Hz-11MHz	01	

IX Precautions to be followed (if any)

Connect the function generator output to the CRO's channel using CRO probe properly.

X Procedure

1)Connect the function generator output to the CRO's channel using CRO probe.
2) Adjust the volt per division and time per division of CRO such that the waveform of the current or voltage can be observed properly.
3) Adjust the peak to peak value of voltage.
4) Measure and note down the time period and peak value of sine wave.
5) Switch off the supply.

XI Actual procedure followed

1) Connect function generator out put to CRO 1st Channel using CRO Probe 2) Adjust Volt/div, Time/div control to get proper visual of wave form on the Screen.

XII Resources used (with major specifications)

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	CRO with probe		10Hz - 30MHz	01	
2.	Function Generator		0.1Hz - 11MHz	01	
3.					
4.					

XIII Precautions followed

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XIV Observations

1. Time period of ac waveform (T)= .2.....division.
2. Peak value of ac waveform = .3.4.....division.
3. Time per division = 1ms
4. Voltsper division = 2v/div

Calculations-

1) Time period of ac waveform (T)= .2 div x 1m..time per div=2m sec.
2) Peak value of ac waveform =3.4 div x 2.volt per div=6.8.v.
3) R.M.S value of ac waveform=Peak value x 0.707=4.80v
4) Average value of ac waveform=Peak value x 0.637=4.3.v

XV Results

1. Time period=2m..sec.
2. Peak value=6.8.v.
3. R.M.S value=4.80v.
4. Average value=4.33v.

XVI Interpretation of results (Giving meaning to the results)

To measure voltage on CRO volt per division control is used.
To measure voltage on CRO time per division control is used. time period.

XVII Conclusions and Recommendations (Actions to be taken based on the interpretations)

CRO is used to measured voltage and time period of the applied signal.

XVIII Sample Practical Related Questions.

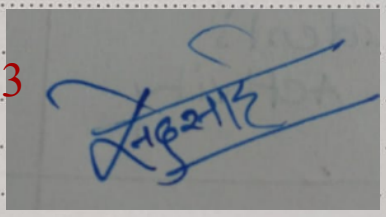
Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. The value indicated by electrical measuring instrument is.....(average value/rms value)

[Space for Answer]

The value indicated by electrical engineering measurement instrument is RMS Value

14+9=23



Practical No. 03: Determine frequency time period, peak value, rms value, peak factor, form factor, of a Sinusoidal A.C. waveform on CRO part II.

I Practical Significance

An alternating ac waveform is one that varies in both magnitude and direction in more or less an even manner with respect to time. An AC function can mathematically represent either a power source or a signal source with the shape of an *AC waveform.*

Peak factor and Form factor of different wave shapes are different.

II Relevant Program Outcomes (POs)

PO1- Basic knowledge- *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems*

PO3- Experiments and practice- *Plan to perform experiments and practices to use the results to solve broad-based interdisciplinary engineering problems.*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **'Use electrical equipments in industrial applications'**

i. Measure electrical quantities.
ii. Circuit connection.
iii. Follow safe practices.

IV Relevant Course Outcomes

Use single phase AC supply for Electrical and electronic equipments.

V Practical Outcome

Determine peak factor and form factor of a sinusoidal A.C. waveform by observing it on C.R.O.

VI Minimum Theoretical Background

AC Waveform Characteristics

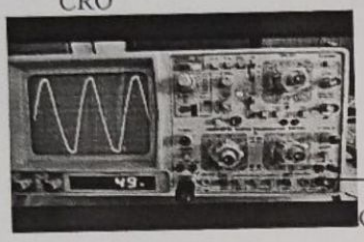
Form Factor: The **form factor** of an alternating current waveform (signal) is the ratio of the RMS (root mean square) value to the average value of waveform

Peak Factor or Crest **factor** is a measure of a waveform, such as alternating current showing the ratio of **peak** values to the rms value

VII Circuit diagram

Function generator

CRO



CRO probe

VIII Resources required

S. No.	Name of Instrument	Specifications	Quantity	Remarks
1	CRO with probe	10Hz-30MHz	01	
2	Function generator	0.1 Hz-11MHz	01	

IX Precautions to be followed (if any)

Connect the function generator output to the CRO's channel using CRO probe Properly.

X Procedure

1)Connect the function generator output to the CRO's channel using CRO probe.
2) Adjust the volt per division and time per division of CRO such that the waveform of the current or voltage can be observed properly.
3) Adjust the peak to peak value of voltage.
4) Measure and note down the time period and peak value of sine wave.
5) Switch off the supply.

XI Resources used (with major specifications)

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	CRO with Probe		10Hz - 30MHz	01	
2.	Function Generator		0.1Hz - 11MHz	01	
3.					
4.					

XII Actual Procedure followed

1) Connect function generater output to CRO's channel no 1 using CRO probe.

2) Adjust Volt/div, Time/div control to get proper visual of waveform on screen.

XIII Precautions followed

XIV Observations

1. Time period of ac waveform (T)= 1·2 division.
2. Peak value of ac waveform = 01 division.
3. Time per division = 1ms
4. Volts per division = 2

Calculations-

1) Time period of ac waveform (T)= 1·2 div x 1 time per div= 1·2 sec.
2) Peak value of ac waveform = 1 div x 2 volt per div= 2 v.
3) R.M.S value of ac waveform=Peak value x 0.707= 1·41 v
4) Average value of ac waveform=Peak value x 0.637= 1·27 v
5) Peak factor=Peak value/R.M.S value 1·4144
6) Form factor=R.M.S value/Average value 1·113

XV Results

1. Time period= 1·2 sec.
2. Peak value= 2 v.
3. R.M.S value= 1·41 v.
4. Average value= 1·27 v.
5. Peak factor= 1·414
6. Form factor= 1·113

XVI Interpretation of results (Giving meaning to the results)

Form factor and peak factor are circulated from the observed value of voltage of Applied Signal.

XVII Conclusions and Recommendations (Actions to be taken based on the interpretations)

This experiment could explain the procedure to Determine peak factor and form factor of AC waveform.

XVIII Sample Practical Related Questions.

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Calculate form factor and peak factor for 50 Hz sinusoidal AC supply.

[Space for Answer]

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	8	22	

Practical No. 06 : Connect balanced star and delta load connections to get the required voltage and current. Part I.

I Practical Significance

In practice large power applications use three phase systems. In a three phase circuit loads can be connected in balanced star and delta mode. It is necessary to formulate voltage and current relations for system parameters for testing, calculations and interpretations.

II Relevant Program Outcomes (POs)

PO 1- Basic knowledge - *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems.*

PO3- Experiments and practice- *Plan to perform experiments and practices to use the results to solve broad-based interdisciplinary engineering problems..*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified

Competency **'Use electrical equipments in industrial applications'**

i. Measure electrical quantities.
ii. Circuit connection.
iii. Follow safe practices.

IV Relevant Course Outcome(s)

Use three phase AC supply for industrial equipment and machines.

V Practical Outcome

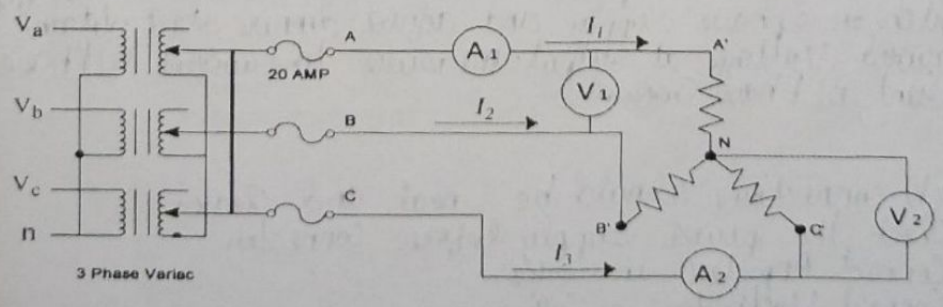
Determine the relation between line and phase values of voltages and currents for balanced star connected load.

VI Minimum Theoretical Background

Three-phase balanced networks are used in the power industry for reasons of economy and performance. Three-phase generators and motors run smoothly, with no torque pulsations, unlike single phase machines. In addition balanced three phase systems may be operated as three wire or four wire systems, with much less copper needed for the power delivered as compared with three single phase systems.

VII Experimental set-up

For star connected balanced load:



VIII Resources required

S. No.	Particulars	Specification	Quantity	Remark
1	Three phase variac	Suitable Three phase variac	1	
2	Three phase load	Suitable Three phase load	1	
3	Ammeter	Suitable Ammeter	2	
4	Voltmeter	Suitable Voltmeter	2	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.
3. Connect Ammeter in series.
4. Connect Voltmeter in parallel
5. Use only balanced load

X Procedure

1. Connect the three-phase Star circuit as shown in figure.
2. Switch on three phase supply and adjust dimmerstat to obtain required voltage at output
3. Measure line current(A_1), phase current (A_2), phase voltage(V_2), line voltage (V_1)
4. Repeat 3 and 4 for different input voltages.

XI Resources used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Three Phase Variac		Suitable Three Phase Variac	01	
2.	Three Phase Load		Suitable Three Phase load	01	
3.	Ammeter		Suitable Ammeter	02	
4.	Voltmeter		Suitable Voltmeter	02	

XII Actual procedure followed

01) Connect the three phase star circuit as shown in fig. switch on 3 phase supply and adjust dimmer stat to obtain required voltage at output measure line current, A) Phase current, B) Phase Current

XIII Precautions Followed

1) All connections should be neat and clear.
2) Check the power supply before connection.
3) Connect Ammeter in Series.
4) Connect Voltmeter in Series
5) Used only to balance load.

XIV Observations and Calculations

Star connected load:

S. No.	Line voltage V_L	Phase voltage -V_{ph}	Ratio V_L/V_{ph}	Line current-I_L	Phase current-I_{ph}	Ratio I_L/I_{ph}
1.	250	146.0	=1.71	2.41mA	2.41mA	= 1 mA
2.	200	115.8	=1.72	2.12mA	1.72mA	= 1 mA
3.	150	089.1	=1.68	1.84mA	1.84mA	= 1 mA
4.	406	246.0	=1.731	74mA	74mA	= 1mA

XV Results

The Ratio of I_L I_{PH} is found to be 1 and ratio of the Voltage to Phase voltage is $\sqrt{3}$.

XVI Interpretation of results (Giving meaning to the results)

The Ratio of I_L I_{PH} is found to be 1 and ratio of the Voltage to Phase Voltage is $\sqrt{3}$.

XVII Conclusions and Recommendations ((Actions to be taken based on the interpretations)

The Ratio of I_L I_{PH} is found to be 1 and ratio of the Voltage to Phase Voltage is $\sqrt{3}$.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State relation between line voltage and line current in Star connection.
2. Write relation for power drawn in three phase star connected load.
3. State meaning of balanced load.
4. State meaning of unbalanced load.
5. Write value of neutral current and neutral voltage in balanced load.

[Space for Answer]

Answer 02) line current = $\sqrt{3}$ X Phase current
line Voltage = Phase Voltage

Answer 02) $P = \sqrt{3} V_2 / pH \cos\phi$ watts

Answer 03) Nature of load magnitude of load phase angle of load are same in all phases then it is a balanced load.

Answer 04) Nature of load magnitude of load phase angle of load are not same in all phases then it is known as unbalanced load.

Answer 05) The Value of of neutral voltage and neutral current in balance load is 0.

Space to write answers

STAR CONNECTION:

Answer 01) line Current = Phase Current
line Voltage = Phase Voltage × $\sqrt{3}$

Answer 02) Power = $\sqrt{3} \times V_L \times I_L \times \cos\phi$

Answer 03) Nature of load, magnitude of load phase angle of load, are same in all places then it is a balanced load.

Answer 04) Nature of load, magnitude of load phase angle of load are not same in all places then it is a unbalanced load.

Answer 05) The Value of neutral Voltage and neutral current in balance load is 0.

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	9	23	

Practical No. 07: Connect balanced star and delta load connections to get the required voltage and current. Part II

I Practical Significance

In practice large power applications use three phase systems. In a three phase circuit loads can be connected in balanced star and delta mode. It is necessary to formulate voltage and current relations for system parameters testing, calculations and interpretations.

II Relevant Program Outcomes (POs)

PO 1- Basic knowledge - *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems.*

PO3- Experiments and practice- *Plan to perform experiments and practices to use the results to solve broad-based interdisciplinary engineering problems.*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified

Competency **'Use electrical equipments in industrial applications'**

i. Measure electrical quantities.
ii. Circuit connection.
iii. Follow safe practices.

IV Relevant Course Outcome(s)

Use three phase AC supply for industrial equipment and machines

V Practical Outcome

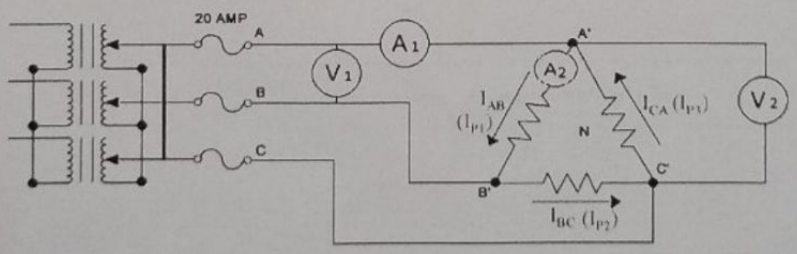
Determine the relation between line and phase values of voltages and currents for balanced Delta connected load.

VI Minimum Theoretical Background

Three-phase balanced networks are used in the power industry for reasons of economy and performance. Three-phase generators and motors run smoothly, with no torque pulsations, unlike single phase machines. In addition balanced three phase systems may be operated as three wire or four wire systems, with much less copper needed for the power delivered as compared with three single phase systems.

VII Experimental set-up

For delta connected balanced load:



VIII Resources required

S. No.	Particulars	Specification	Quantity	Remark
1	Three phase variac	Suitable Three phase variac	1	
2	Three phase load	Suitable Three phase load	1	
3	Ammeter	Suitable Ammeter	2	
4	Voltmeter	Suitable Voltmeter	2	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.
3. Connect Ammeter in series.
4. Connect Voltmeter in parallel.
5. Use only balanced load

X Procedure

1. Connect the three-phase Delta circuit as shown in figure.
2. Switch on three phase supply and adjust dimmerstat to obtain required voltage at output
3. Measure line current(A_1), phase current (A_2), phase voltage(V_2), line voltage (V_1)
4. Repeat 3 and 4 for different input voltages.

XI Resources used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Three Phase Variac		Suitable Three Phase Variac	01	
2.	Three Phase Load		Suitable Three Phase Load	01	
3.	Ammeter		Suitable Ammeter	02	
4.	Voltmeter		Suitable Voltmeter	02	

XII Actual procedure followed

Connect the 3 phase stella circuit has shown in the fig.
Switch on the three phase supply and adjust dimmerstat
start to obtain required voltage at output.

XIII Precautions Followed

01) All connections should be neat and clear.
02) Check the power supply
03) Connect Ammeter in series

XIV Observations and Calculations

Delta connected load:

S.N.	Line voltage V_L	Phase voltage -V_{ph}	Ratio V_L/V_{ph}	Line current-I_L	Phase current-I_{ph}	Ratio I_L/I_{ph}
1	430	430	1	225.1mA	129.4mA	1.73mA
2	148	148	1	210.0mA	121.0mA	1.72mA
3	145	145	1	3.11mA	1.79mA	1.71mA
4	140	140	1	4.08mA	2.35mA	1.73mA

XV Results

The ratio of I_L I_{PH} is found to be $\sqrt{3}$ and the ratio of the voltage to phase voltage is 1.

XVI Interpretation of results (Giving meaning to the results)

The ratio of I_L I_{PH} is found to be $\sqrt{3}$ and the ratio of the voltage to phase voltage is 1.

XVII Conclusions and Recommendations (Actions to be taken based on the interpretations)

The ratio I_L I_{PH} is found to be $\sqrt{3}$ and the ratio of the voltage to phase voltage of.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more suchquestions so as to ensure the achievement of identified CO.

1. State relation between line voltage and line current in delta connection.
2. Write relation for power drawn in three phase delta connected load.
3. State meaning of balanced load.
4. State meaning of unbalanced load.

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	9	23	

[Space for Answer]

Answer Q2) line Current = Phase Current
line Voltage = $\sqrt{3}$ × Pase Voltage

Answer Q2) $P = \sqrt{3} \, I_l / p_l \cos\phi$ watts

Answer Q4) Nature of load, magnitude of load phase angle of load, are same in all phases then it is a balanced load.

Answer Q3) Nature of load, magnitude of load phase angle of load are not same in all places then it is unbalanced load.

Space to write answers

DELTA CONNECTION:

Answer 01) line Current = Phase Current $\times \sqrt{3}$
line Voltage = Phase Voltage

Answer 02) Power = $\sqrt{3} \times V_L \times V_L \times \cos\phi$

Answer 03) Nature of load, magnitude of load phase angle of load, are same in all places then it is a balanced load.

Answer 04) Nature of load, magnitude of load phase angle of load, are not same in all places then it is a un balanced load.

Practical No. 08: Determine Voltage and Current ratio of Single Phase Transformer.

I Practical Significance

A Single Phase Transformer is used for changing voltage levels in electronic circuits. Mostly electronic devices/ circuits are energized with DC Supply. To lower the voltage level of AC Supply voltage a transformer is used and this lowered AC Voltage level further rectified to DC Supply. Voltage ratio of a transformer decides increasing or decreasing voltage level.

II Relevant Program Outcomes (POs)

PO1- Basic knowledge- *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based inter-disciplinary engineering problems*

PO3- Experiments and practice- *Plan to perform experiments and practices to use the results to solve broad-based inter-disciplinary engineering problems*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **'Use electrical equipment in industrial applications'.**

i. Measure electrical quantities.
ii. Circuit connection.
iii. Follow safe practices.

IV Relevant Course Outcomes

Use transformers for specific requirements.

V Practical Outcome

Determine voltage and current ratio of single phase transformer.

VI Minimum Theoretical Background

The voltage ratio of a transformer is equal to the ratio of secondary voltage and Primary voltage

$a=V_P/V_s$

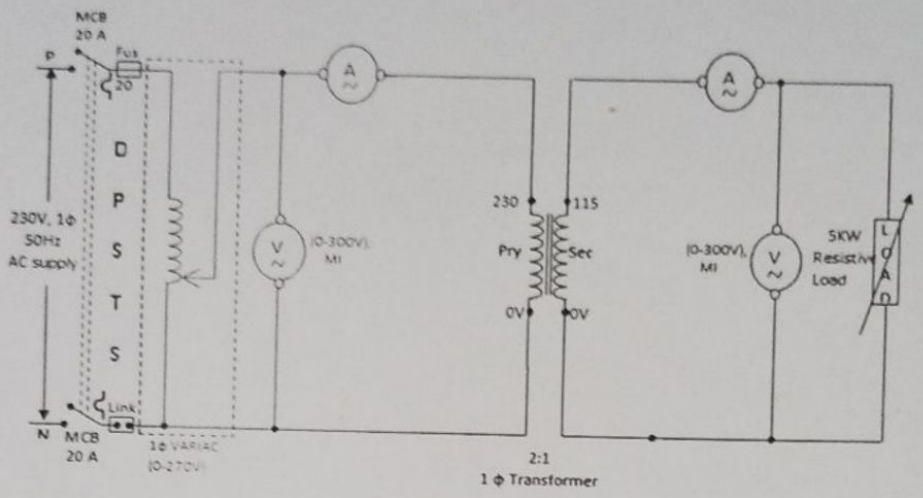
where: V_P – primary voltage
V_s – Secondary voltage

The current ratio of a transformer is equal to the ratio of primary current and Secondary current.

$b=I_p/I_s$

where: I_p – primary current
I_s – secondary current

VII Circuit diagram



VIII Resources required

S. No.	Instrument/Object	Specifications	Quantity	Remark
1	Ammeter	0-10 A AC	2	
2	Voltmeter	0-300 V AC	2	
3	Single Phase Transformer	1 kVA 230/ 115 V. Single Phase Transformer	1	
4	Resistive load	Single Phase 230 V , 15 A, Resistive load	1	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.

X Procedure

1. Connect equipment as per circuit diagram.
2. Switch on power supply.
3. Note down reading of ammeter and voltmeter.
4. Calculate current ratio and voltage ratio.

XI Resources used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Ammeter		0-10A AC	02	
2.	Voltmeter		0-300V AC	02	
3.	Single Phase Transformer		1KVA/115V	01	
4.	Resistive load		Single Phase 230V, 15A	01	

XII Actual procedure followed

REFER POINT NUMBER X.

XIII Precautions followed

REFER POINT NUMBER IX

XIV Observations and Calculations

S. No.	Ip	Is	Vp	Vs	CURRENT RATIO=Ip/Is	VOLTAGE RATIO=Vp/Vs
1	0.91	1.50	50	24	$\frac{0.91}{1.50} = 0.667$	$\frac{50}{24} = 2.083$
2	1.62	3.01	100	48.2	$\frac{1.62}{3.02} = 0.538$	$\frac{100}{48.2} = 2.074$
3	2.54	4.97	150	72	$\frac{2.54}{4.97} = 0.511$	$\frac{150}{72} = 2.083$
4	1.85	3.51	200	96	$\frac{1.85}{3.51} = 0.527$	$\frac{200}{96} = 2.083$

XV Results

Voltage Ratio is found to 0.56 and Current ratio is found 2083 for given Transformer.

XVI. Interpretation of results (Giving meaning to the results)

The voltage ratio found out to be 0.56 V of the secondary winding irrespective of the primary winding the current ratio found to be 0.32A the primary winding of transformer to the secondary winding

XVII. Conclusions and Recommendations(Actions to be taken based on the interpretations)

Current Ratio is inversely proportional to Voltage Ratio

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Give applications of step up transformer.
2. Give applications of step down transformer.

[Space for Answer]

Answer 01) Transformer are used extensively in AC power system for transmission and Distribution of electrical power.

Answer 02) They are used in numerous industrial, commercial, domestic application such as voltage stabilizer, Transmission into step down, power distribution network, inverter, welding machine etc.

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XIX References / Suggestions for Further Reading

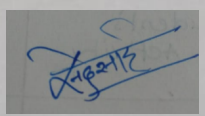
1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	8	22	

Practical No.09: Operate DC Shunt Motor using Three point Starter.

I Practical Significance

DC Shunt Motor draws very high current during starting which may burn armature winding. Hence to protect DC Shunt Motor from damages due to heavy starting current, Three Point Starter is used to start DC Shunt Motor.

II Relevant Program Outcomes (POs)

PO3 - **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based inter- disciplinary engineering problems.
PO 4. Engineering tools: Apply relevant Electrical technologies and tools with an understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Use electrical equipment in industrial applications'.**

1. Identify armature winding and field winding terminals of DC Shunt Motor.
2. Identify different parts of Three Point Starter.

IV Relevant Course Outcome(s)

Connect DC Motors for specific requirements.

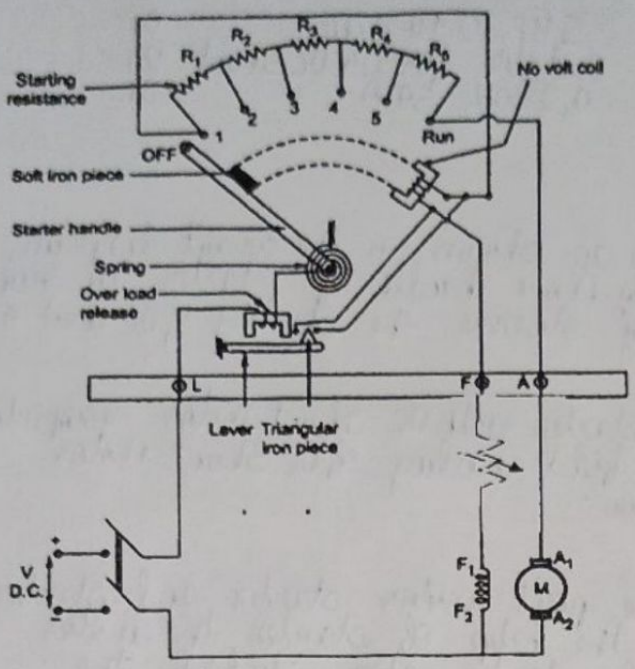
V Practical Outcome

Start DC Shunt Motor with the help of Three Point Starter.

VI Minimum Theoretical Background

3 Point Starter is a device whose main function is starting of DC shunt motor. The three point starter connects the resistance in series with the circuit which reduces the high starting current and hence protects the machines from damage.

VII Circuit diagram



Three Point Starter

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	DC Shunt Motor	5 HP, 220 V DC	1 No.
2	Three Point Starter	Suitable for 5 HP DC Shunt Motor	1 No.
3	Variable DC Supply	0-230 Volt, 50 amp	1 No.

IX Precautions to be followed

1. Connect Three point Starter with DC Shunt motor properly.
2. Keep rheostat of field winding of DC Shunt Motor minimum position.

X Procedure

1. Connect the apparatus as shown in circuit diagram.
2. Switch on DC Supply.
3. Move handle of starter from start to run position gradually.
4. Observe the starting of DC Shunt Motor.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	DC Shunt motor		5 HP, 240 VDC	01	
2.	Three Point Starter		Suitable for 5 HP DC shunt	01	
3.	Variable DC motor		0 230V, 50 A.	01	
4.					

XII Actual Procedure Followed

Connect the apparatus as shown in the circuit diagram. Switch on DC Supply. Move handle of starter to run position gradually observe the starting of DC shunt motor.

XIII Precautions Followed

Connect three motor starter with DC shunt motor properly. Lap the restart of field winding of DC Shunt motor, in running position.

XIV Observations and Calculations

Studied the three point motor starter and starter the motor with the help of starter the motor with the help of starter also studied the protected device (NVC and OLB)

XV Results

The DC Shunt Motor is started with the help of three point starter.

XVI Interpretation of Results (Giving meaning to the results)

Starter the motor with starter and observe the motor running safely at normal side.

XVII Conclusions (Actions to be taken based on the interpretations.)

Studied the three point motor starter and starter the motor with the help of starter also studied the protected device (NVC and OLB)

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more suchquestionsso as to ensure the achievement of identified CO.

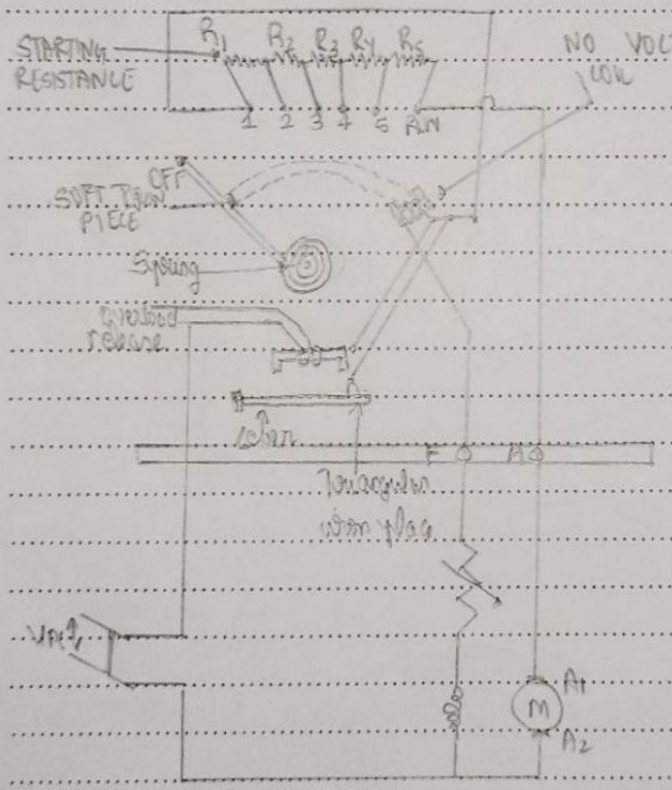
1. "Starter is necessary for starting of DC Motor." Give reason.
2. Write functions of different parts of Three Point Starter.

[Space for Answer]

Answer 01) while starting, DC motor, The starting input current is very high which can damage the winding I coil of the motor. So, to limit the starting is necessary for starting of DC Motor.

Answer 02) NCV - No voltage will protect the supply the motor from intermity supply to motor failure during operation.

(ii) OLR - Protect the motor a from circuit, and over load circuit.



THREE POINT STARTER

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XIX References / Suggestions for Further Reading

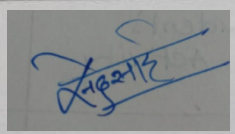
1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX. Suggested Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (15 Marks)		60%	
1	Handling of the instrument	20%	
2	Operation of starter	30%	
3	Working in team	10%	
Product Related (10 Marks)		40%	
4	Interpretation of result	20%	
5	Conclusion	10%	
6	Practical related questions	10%	
	Total (25 Marks)	100 %	

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
15	9	24	

Practical No.10: Operate DC Shunt Motor using Four point Starter.

I Practical Significance

Four Point starters can also be used for starting of DC Shunt Motor.

II Relevant Program Outcomes (POs)

PO3 - **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based inter- disciplinary engineering problems.
PO 4. Engineering tools: Apply relevant Electrical technologies and tools with an Understanding of the limitations

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Use electrical equipment in industrial applications'.**

1. Identify different parts of Four Point Starter.
2. Connect Four Point Starter with DC Shunt Motor.

IV Relevant Course Outcome(s)

Connect DC Motors for specific requirements.

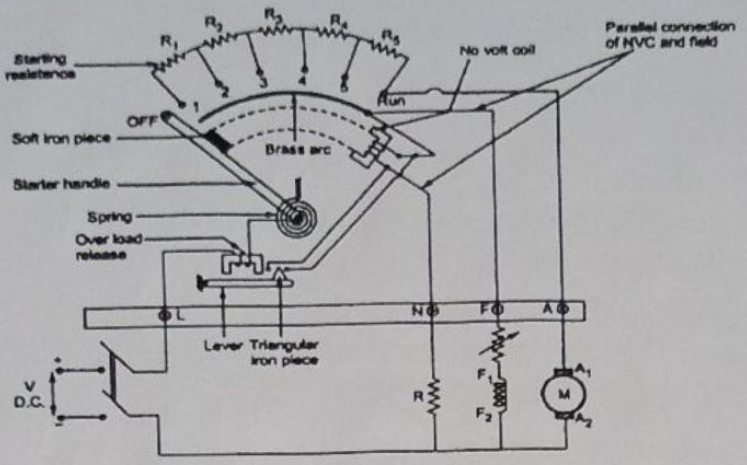
V Practical Outcome

Start DC Shunt Motor with the help of Four Point Starter.

VI Minimum Theoretical Background

The **4 point starter** like in the case of a 3 point starter also acts as a protective device that helps in safeguarding the armature of the shunt or compound excited DC motor against the high starting current produced in the absence of back emf at starting. The 4 point starter has a lot of constructional and functional similarity to a three point starter, but this special device has an additional point and a coil in its construction. This naturally brings about some difference in its functionality, though the basic operational characteristic remains the same. The basic difference in circuit of **4 point starter** as compared to 3 point starter is that the hold ON coil is removed from the shunt field current and is connected directly across the line with current limiting resistance in series.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	DC Shunt Motor	5 HP, 220 V DC	1 No.
2	Four Point Starter	Suitable for 5 HP DC Shunt Motor	1 No.
3	Variable DC Supply	0-230 Volt, 50 amp	1 No.

IX Precautions to be followed

1. Connect Three point Starter with DC Shunt motor properly.
2. Keep rheostat of field winding of DC Shunt Motor minimum position.

X Procedure

1. Connect the apparatus as shown in circuit diagram.
2. Switch on DC Supply.
3. Move handle of starter from start to run position gradually.
4. Observe the starting of DC Shunt Motor.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	DC Shunt Motor		5HP 220 V DC		
2.	4 Point Starter		Suitable for 5HP DC Shunt Mot		
3.	Variable DC Supply		0-230 Volt, 50 amp		
4.					

XII Actual Procedure Followed

REFER POINT NUMBER

XIII Precautions Followed

REFER POINT NUMBER.

XIV Observations and Calculations

Studied the 4 point starter and start the motor with the help of starter also studied protective devices (NVC and DCB)

XV Results

The DC Shunt Motor is started with the help of four point starter.

XVI Interpretation of Results (Giving meaning to the results)

Start the motor with starter and observe the motor running safely at normal speed.

XVII Conclusions (Actions to be taken based on the interpretations)

Studied the 4 point motor starter and start the motor with the help of starter also studied protective device

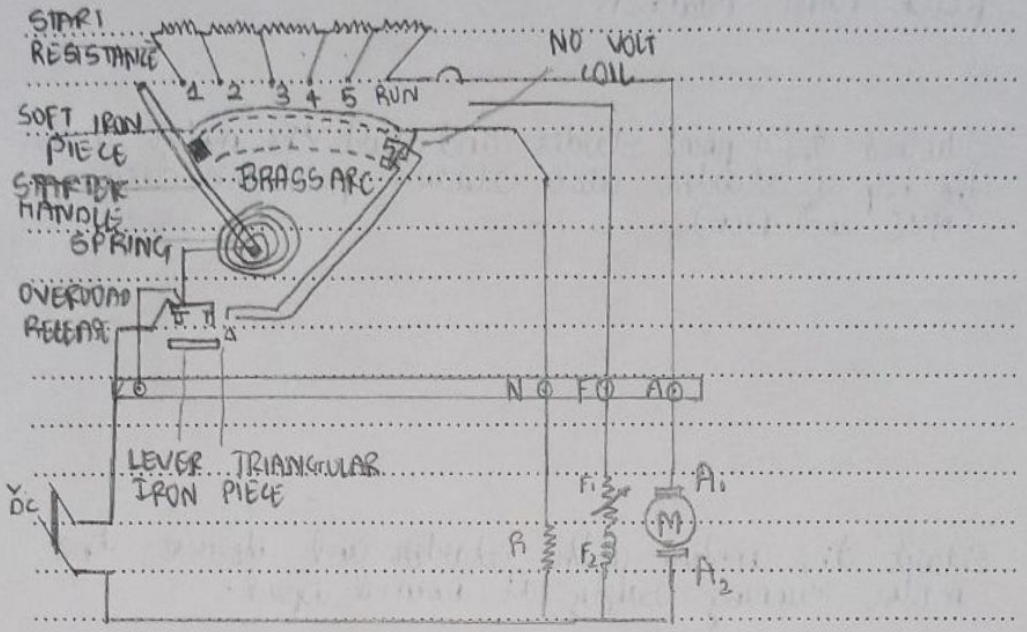
XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Write difference between Three Point starter and Four Point starter.
2. Draw circuit diagram for connecting Four Point Starter with DC Compound Motor.

[Space for Answer]

Answer 01) In 4 point starter there is always fixed point current through NVC where


START
RESISTANCE
1 2 3 4 5 RUN
NO VOLT
COIL
SOFT IRON
PIECE
BRASS ARC
HANDLE
SPRING
OVERLOAD
RELEASE
N O F O A O
LEVER TRIANGULAR
IRON PIECE
V
DC
R
F1
F2
A1
A2
M

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (15 Marks)		60%	
1	Handling of the instrument	20%	
2	Operation of starter	30%	
3	Working in team	10%	
Product Related (10 Marks)		40%	
4	Interpretation of result	20%	
5	Conclusion	10%	
6	Practical related questions	10%	
	Total (25 Marks)	100 %	

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	8	22	

Practical No.11: Reverse direction of rotation of single phase induction motor.

I Practical Significance

Single Phase Induction Motoris necessary in some industrial process application.

II Relevant Program Outcomes (POs)

PO 1- Basic knowledge - *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based inter-disciplinary engineering problems.*

PO 2- Discipline knowledge –*Apply medical electronics engineering knowledge to solve broad-based inter-disciplinary engineering related problems.*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **'Use electrical equipment in industrial applications'.**

i) Identify terminals of starting and running winding of Single Phase Induction Motor.

ii) Reverse detection of rotation of Single Phase Induction Motor.

IV Relevant Course Outcome(s)

Use FHP motors for diversified applications.

V Practical Outcome

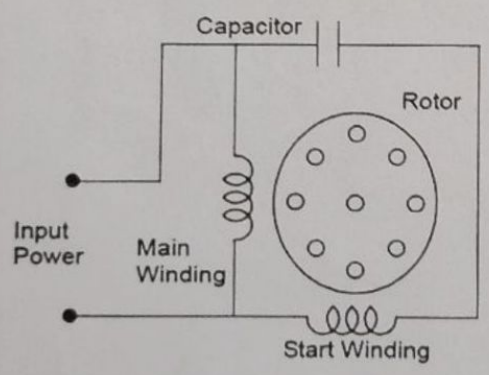
Reverse the direction of rotation of single phase induction motor.

VI Minimum Theoretical Background

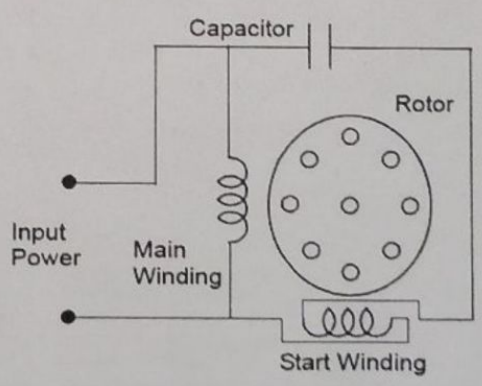
Single phase induction motor direction can be reversed by changing terminals of starting winding or main winding.

VII Experimental set-up

Permanent Split Capacitor Run Motor

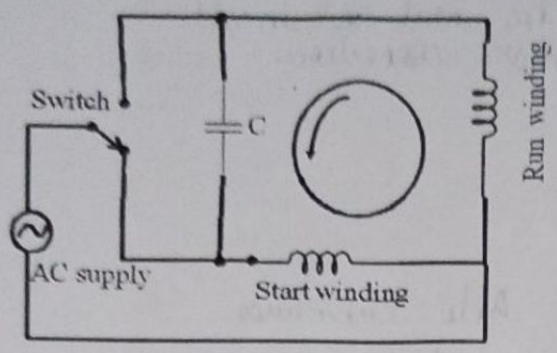


Normal Direction

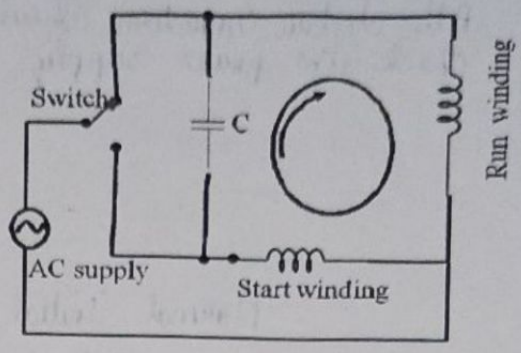


Reversing Direction of Rotation

Reversing single Phase Induction Motor by using External switch



Normal Direction



Reverse Direction

VIII Resources required

S. No.	Particulars	Specification	Quantity	Remark
1	Single Phase Induction Motor	¼ HP , Single Phase , 230 V	1	
2	Single phase supply	Single Phase, 230 V AC	1	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.

X Procedure

1. Connect circuit as per circuit diagram.
2. Switch on the supply.
3. Start the motor and check the direction of rotation.
4. Change starting winding terminals and check the direction of rotation.

XI Resources used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Single Phase Induction motor		1/4 HP Single Phase, 230V	01	
2.	Single Phase Supply		Single Phase, 230VAC	01	
3.					
4.					

XII Actual procedure followed

Connect circuit as per circuit Diagram switch on the supply. Start motor and check the direction of rotation change starting winding terminals and check direction of rotation.

XIII Precautions Followed

All electric connection should be neat and upright.
check the power supply before connection.

XIV Observations and Calculations

S.N.	Winding terminal Initial / interchanged	Rotation of motor Clockwise or Anticlockwise
1	Normal / Initial	Anti - clockwise
2	Reverse / Interchange	clockwise

XV Results

Motor Supply given to the motor with normal connection motor anticlockwise direction the interchange connection of start winding motor rotate in opposite direction.

XVI Interpretation of results (Giving meaning to the results)

By interchanging the terminals of either starter winding we can change the direction of motivation

XVII Conclusions and Recommendations (Actions to be taken based on the interpretations)

By interchanging the terminals of either starting winding or main winding with iron change the direction of rotation.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Give different types of Single Phase Induction Motors.
2. "Single phase Motors are not self-starting". Explain this statement.

[Space for Answer]

Answer 1) (a) Shaded pole induction motor.
(b) Universal induction motor.
(c) Repulsion type single phase

Answer 02) In case of three three phase induction motor starter produces rotating flux, which rotates as synchronous speed is out it single phase induction motor flux is alternating. Hence, it is not self starting to make single phase induction motor to make temporary covered into two phase motor by adding on a more winding known as starting winding 90° as shown. A centrigal switch connected in series with starting winding disconnected this winding from supply when motor gets to 80 to 90 % rated speed.

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XIX References / Suggestions for Further Reading

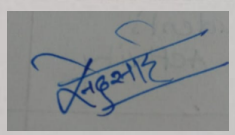
1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		60%
1	Handling of the components	20 %
2	Identification of component	20 %
3	Working in team	20 %
Product related (10 Marks)		40%
4	Interpretation of result	10 %
5	Conclusions	10 %
6	Practical related questions	15 %
7	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
13	10	23	

Practical No.12: Reverse the direction of rotation of Universal motor.

I Practical Significance

Reversal of rotation of Universal motoris a necessary in many of the electrical applications.

II Relevant Program Outcomes (POs)

PO 1- Basic knowledge - *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based interdisciplinary engineering problems.*

PO3- Experiments and practice- *Plan to perform experiments and practices to use the results to solve broad-based interdisciplinary engineering problems*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency **'Use electrical equipments in industrial applications'**

i. Measure electrical quantities.
ii. Connect circuits as per the requirement.
iii. Follow safe practices.

IV Relevant Course Outcome(s)

Use FHP motors for diversified applications.

V Practical Outcome

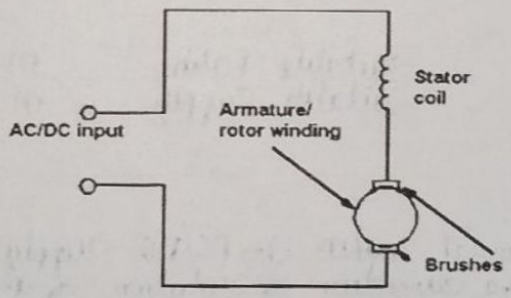
Reverse the direction of rotation of Universal motor.

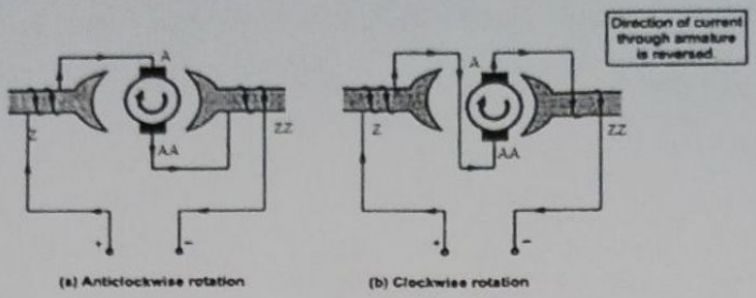
VI Minimum Theoretical Background

Universal motor can be operated on AC and DC supply.

VII Experimental set-up

Simple universal motor schematic





VIII Resources required

S. No.	Particulars	Specification	Quantity	Remark
1	Universal motor	Suitable rating	1	
2	Supply ac or dc	Suitable supply	1	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.

X Procedure

1. Connect universal motor to AC/DC supply.
2. Observe the direction of rotation of motor.
3. Change the armature winding terminal.
4. Observe the direction of rotation of motor.

XI Resources used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Universal Motor		Suitable Rating	01	
2.	Supply AC or DC		Suitable Supply	01	
3.					
4.					

XII Actual procedure followed

01) Connect universal motor to AC/DC supply.
02) Observe the direction of rotation of motor.
03) Change the armature winding terminal.

XIII Precautions Followed

01) All electrical connection should be neat & tight.
02) Check the power supply before connection.

XIV Observations and Calculations

S.N.	Winding connection	Rotation
1	Normal	Clockwise
2	Reversed	Anticlockwise

XV Results

Motor supply given to the motor with normal connection motor to take anti-clockwise direction. the interchange connection of starting winding motor rotate opposite direction.

XVI Interpretation of results (Giving meaning to the results)

By interchanging the terminals of starting winding or main winding we can change the direction of rotation.

XVII Conclusions and Recommendations (Actions to be taken based on the interpretations.)

By interchanging the terminal of either start winding or main winding we can change the direction of rotation.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more suchquestions so as to ensure the achievement of identified CO.

1. Give application of universal motor.

[Space for Answer]

Answer :- Mixer, Grinder, drilling etc.

Question 02) What are different types of HP motors

Answer 02)

(i) Universal Motor :

Universal motor are small capacity series motor designed to operate on either direct current (D.C) or single phase alternating current supply for approximately the same voltage with nearly similar operating characteristic

(ii) Stepper Motor:

A stepper motor is an electrical motor which converts electrical input in the form of series on pulse into discrete angular movements commonly called as steps

(iii) Shaded Pole motor

The Shaded pole motor generally has a defined direction of rotation which cannot be reversed.

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	20 %
2	Identification of component	30 %
3	Working in team	10 %
Product related (10 Marks)		**40%**
4	Interpretation of result	10 %
5	Conclusions	10 %
6	Practical related questions	15 %
7	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	9	23	

Practical No.15: Test a circuit using Series Lamp and Multimeter.

I Practical Significance

Testing of electric circuit plays an important role in electrical and electronic equipment's. Testing of components such as relays, solenoids, inductors, chokes, coils, loudspeakers, motors, generators, transformers and electricity meters etc., is necessary for fault finding, satisfactory performance of equipment's, safety of operator , life of equipment etc.

II Relevant Program Outcomes (POs)

PO 1- Basic knowledge - *Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based inter-disciplinary engineering problems.*

PO 2- Discipline knowledge –*Apply medical electronics engineering knowledge to solve inter-disciplinary engineering related problems.*

III Competency and Skills

This practical is expected to develop the following skills for the industry identified Competency**'Use electrical equipment in industrial applications'.**

i) Use multimeter and series lamp.
ii) Test simple electric circuits.
iii) Follow safe practices.

IV Relevant Course Outcome(s)

Use relevant protective device/ switchgear for different requirements.

V Practical Outcome

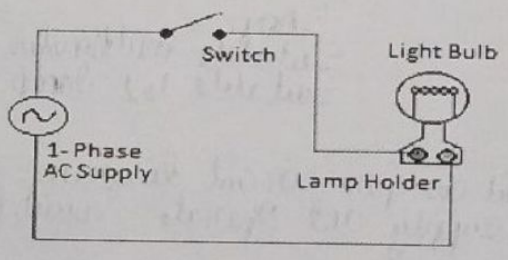
Test circuit using Series Lamp and Multimeter.

VI Minimum Theoretical Background

Amultimeter is an indispensable tool that is used to diagnose and troubleshoot circuits. As its name indicates, it is a meter capable of measuring multiple things related to electricity namely voltage, current and resistance. Multimeter and Test Lamp can be used to find Open circuit and Short Circuit in electric circuit.

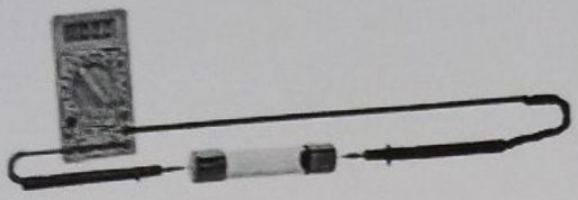
VII Experimental set-up

Use of Test Lamp



Equipment for Test

Test Equipment with the help of Multimeter



VIII Resources required

S. No.	Particulars	Specification	Quantity	Remark
1	Resistance or Equipment	-	1	
2	Switch	5 Amp	1	
3	Multimeter	Suitable multimeter	1	
4	Test lamp	Suitable test lamp	1	

IX Precautions to be followed

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.

X Procedure

1 Connect circuit as per circuit diagram.
2 Switch on supply and operate switch for testing.
3 Use Multimeter for testing given equipment.
4 Repeat the procedure with other equipment.

XI Resources used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Resistance/			01	
2.	Switch		5 Amp	01	
3.	Multimeter		Suitable multimeter	01	
4.	Test lamp		Suitable test lamp	01	

XII Actual procedure followed

Connect circuit as per circuit diagram.
Switch on supply and operate switch for testing.

XIII Precautions Followed

All electrical connection should be neat and tight.
Check the power supply before connection.

XIV Observations and Calculations

Using Test Lamp Circuit:

S. No.	Lamp Brightness Dim/ Bright/ No	Remark whether equipment is open circuit/ short circuit/not Faulty
1	Dim	Short Circuit
2	Full Brightness	Not Faulty
	No	Open Circuit

Using Multimeter:

S. No.	Resistance Indicated by Multimeter Very Low/ Medium/ Very High	Remark whether equipment is open circuit/ short circuit/not Faulty
1	low	Short Circuit
2	medium	Not Faulty
	Very High	Open Circuit

XV Results

The equipment is tested with the help of Test Lamp and Multimeter and its result is mentioned in Observation Table

XVI Interpretation of results (Giving meaning to the results)

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To test a circuit using series lamp using multimete

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XVII Conclusions and Recommendations (Actions to be taken based on the interpretations.)

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Use relevant protective devices for different variant

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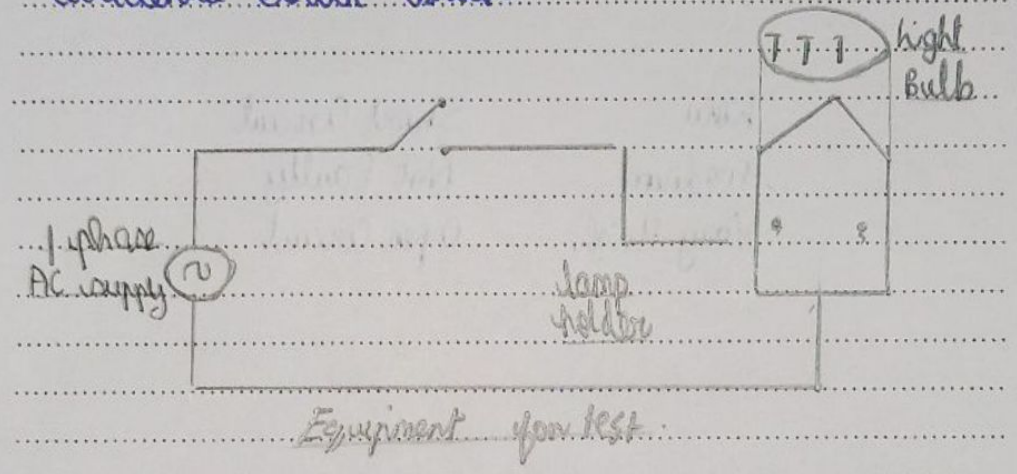
XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO

1. Write necessary conditions for using Test Series Lamp for testing.
2. Draw a diagram for testing choke coil using Series Test lamp
3. Write meaning of 'SERIES' in Series Test Lamp.

[Space for Answer]

Answer of 1 A test light test lamp voltage tester of of mains tests is a piece of electronic test equipment unless test properly designed test lights conducts readers to protect necessary from accidental electric shock



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XIX References / Suggestions for Further Reading

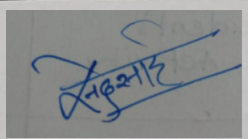
1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	10	24	

Practical No.18: Use of Digital Clamp on Meter for different measurements.

I Practical Significance

Clamp on meter is primarily used for measurement of high current without connecting it into power circuit. Also voltage and other parameters can be measured with clamp on meter.

II Relevant Program Outcomes (POs)

PO1 - **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based inter- disciplinary engineering problems.
PO3 - **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based inter- disciplinary engineering problems.

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency **'Use electrical equipment in industrial applications'.**

1. Measure Current, AC/DC Voltage, Resistance.
2. Select proper ranges for different measurements.

IV Relevant Course Outcome(s)

Use relevant protective device/ switchgear for different requirements.

V Practical Outcome

Use Digital Clamp on Meter for measuring Current, Voltage, and Resistance.

VI Minimum Theoretical Background

Clamp on Meter is an electrical device with jaws which open to allow clamping around an electrical current carrying conductor. It is also used as Multimeter.

VII Circuit diagram

1)Measurement of Current 2)Using as multimeter

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital Clamp on Meter	200 amp,200 ohm, 20 kohm, 1000 V DC,750 V AC	1 No.
2	Connecting Probes	-	2 No.
3	Resistance or Rheostats	100 ohm, 370 ohm, 500 ohm	1 each
4	Variable DC Supply	0-230 Volt	1 No.
5	Dimmerstat	Single Phase 15 Amp, 0-230 V	1 No.
6	Loading Rheostat	Single Phase	1 No.

XIX Precautions to be followed

1. Select proper range and rotate selection knob for quantity to be measured.
2. Use insulating Hand Gloves.

X Procedure

1. Connect load to AC Supply and energize the circuit.
2. Insert clamp on meter by opening its jaws.
3. Measure AC current by changing load.
4. Measure AC voltage by using selector switch.
5. Measure DC Voltage by using varying DC Voltage source.

XI Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	loading Rheostat		Single Phase	01	
2.	Dimmer Stat		Single Phase 15A, 0-230V	01	
3.	Connecting Probes			02	
4.	Variable DC supply		0-230 Volt	01	

XII Actual Procedure Followed

Connect load to AC supply & energize the circuit
Insert Clamp on meter by opening its jaws

XIII Precautions Followed

All connections should be neat and clean
check power supply before connection

XIV Observations and Calculations

S.No.	Current in clamp on meter
1	2·1mA
2	2A

S.No.	AC Voltage indicated by clamp on meter
1	80V
2	417V
3	
4	

S.No.	DC Voltage indicated by clamp on meter
1	20·2V
2	10·6V
3	
4	

S.No.	Resistance indicated by clamp on meter
1	9·76kΩ (10kΩ actual)
2	5Ω (earth resistance)
3	
4	

XV Results

Reading of different quantities are taken and noted in observation table.

XVI Interpretation of Results (Giving meaning to the results)

Clamp on meter readings for current, voltage and resistance are taken and noted in observation table.

XVII Conclusions (Actions to be taken based on the interpretations)

By clamping the clamp on meter around the wire of a connection we get the value current and voltage flowing through it.

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Give list of manufactures of Clamp on Meter.
2. Give applications of Clamp on Meter.

[Space for Answer]

Answer 01) a) Field Piece Clamp Meter
b) Tacklife clamp meter
c) UEi test instrument clamp on meter
d) Ideal industries clamp meter
e) Fluke clamp meter.

Answer 02) These meters are mainly used for measuring high level current, the application of these meters mainly include industrial controls, industrial equipments, commercial, residential electrical system and HVAC.

These are also used to trouble shoot fixing problems, execute fault circuit.

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XIX References / Suggestions for Further Reading

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org

XX Suggested Assessment Scheme

	Performance Indicators	Weightage	Marks obtained
	Process Related (15 Marks)	**60%**	
1	Handling of the instrument	20%	
2	Determination of current & voltage	30%	
3	Working in team	10%	
	Product Related (10 Marks)	**40%**	
4	Conclusion	20%	
5	Practical related questions	20%	
	Total (25 Marks)	100 %	

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	Product Related(10)	Total (25)	
14	10	24	