I

Name _____

Roll No. _____ Year 20____20____

Exam Seat No. _____

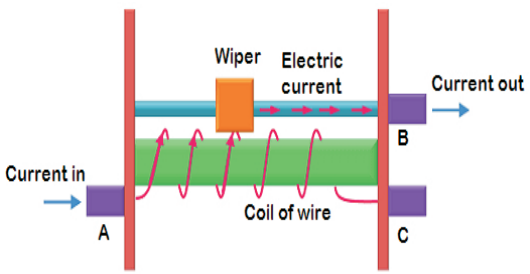
ELECTRICAL GROUP | SEMESTER - II | DIPLOMA IN ENGINEERING AND TECHNOLOGY

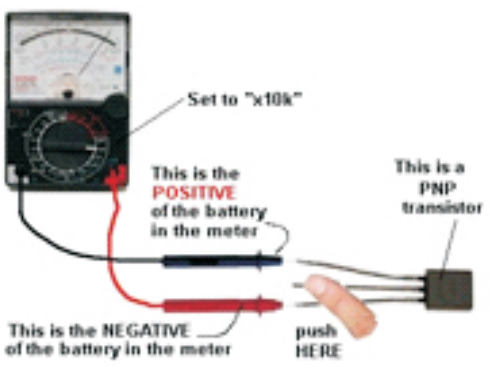
A LABORATORY MANUAL

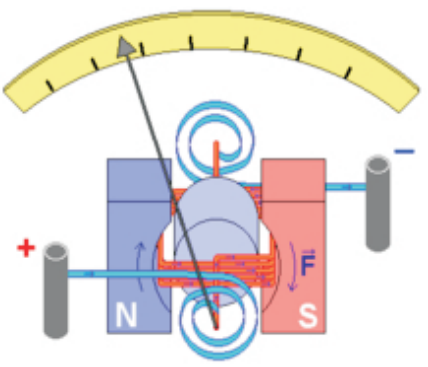
FOR

FUNDAMENTALS OF ELECTRICAL ENGINEERING

(22212)







MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

VISION

To ensure that the Diploma level Technical Education constantly matches the latest requirements of technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the changing technological and environmental challenges.

QUALITY POLICY

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES

MSBTE believes in the followings:

- Education industry produces live products.
- Market requirements do not wait for curriculum changes.
- Question paper is the reflector of academic standards of educational organization.
- Well designed curriculum needs effective implementation too.
- Competency based curriculum is the backbone of need based program.
- Technical skills do need support of life skills.
- Best teachers are the national assets.
- Effective teaching learning process is impossible without learning resources.

A Laboratory Manual for

Fundamentals of Electrical Engineering

(22212)

Semester-II

(EE/EP/EU)

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO 9001:2015) (ISO/IEC 27001:2013)

Maharashtra State Board of Technical Education,
(Autonomous) (ISO 9001 : 2015) (ISO/IEC 27001 : 2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai - 400051.
(Printed on December, 2017)

MAHARASHTRA STATE

BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Mr. / Ms. …… Roll No. ……., of First Semester of Diploma in…….. …… of Institute,…….…….. …… (Code: ……...) has completed the term work satisfactorily in Subject **Fundamentals of Electrical Engineering (22212)** for the academic year 20…….. to 20…….. as prescribed in the curriculum.

Place: …… Enrollment No:.……

Date: …… Exam. Seat No: ……

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

Seal of Institution

Preface

The primary focus of any engineering laboratory/field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering diploma programmes with outcome-based education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practicals to ***focus*** on the ***outcomes***, rather than the traditional age old practice of conducting practicals to 'verify the theory' (which may become a byproduct along the way).

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read through the concerned practical procedure that they will do the next day and understand the minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

The basic aim of this course is that, the student must learn the basic concepts, rules and laws of electric and magnetic circuits and practical thereof. The basic concepts of electrical engineering in this course will be very useful for understanding electrical circuits.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

Programme Outcomes (POs) to be achieved through Practical

Following programme outcomes are expected to be achieved out of the programme outcomes through the practicals of the course on:

PO1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based ElectricalEngineering related problems.

PO2. Discipline knowledge: Apply Electrical Engineeringknowledge to solve broad-based Electrical related problems.

PO3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Electrical Engineering related problems.

PO4. Engineering tools: Apply relevant electrical technologies and tools with an understanding of the limitations.

PO5. The engineer and society: Assess social, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Electrical Engineering.

PO6. Environment and sustainability: Apply Electrical Engineeringsolutions also for sustainable development practices in social and environmental context.

PO7. Ethics: Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Electrical Engineering.

PO8. Individual and team work: Function effectively as a leader and team member in diverse/ multidisciplinary teams.

PO9. Communication: Communicate effectively in oral and written form.

PO10. Life-long learning: Engage in independent and life-long learning activities in the context of technological changes also in the Electrical Engineeringand allied industry.

List of Industry Relevant Skills

The following industry relevant skills of the competency **"Use basic principles of electrical engineering in different applications."** are expected to be developed in student by undertaking the practicals of this laboratory manual.

1. Determine various parameters used in electric circuit.
2. Use of basic laws of electrical engineering.
3. Make use of capacitor in different conditions.
4. Use principles of magnetism.
5. Use principles of electromagnetism.

Guidelines to Teachers

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain prior concepts to the students before starting of each experiment
3. Involve students in performance of each experiment.
4. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
5. Teachers should give opportunity to students for hands on experience after the demonstration.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected from the students by the industry.
8. Finally give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.

Instructions for Students

1. Listen carefully the lecture given by teacher about subject, curriculum, learning structure, skills to be developed.
2. Organize the work in the group.
3. Students shall develop maintenance skill as expected by industries.
4. Student shall attempt to develop related hand-on skills and gain confidence.
5. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
6. Student shall refer technical magazines.
7. Student should develop habit to submit the practicals on date and time.
8. Student should well prepare while submitting write-up of exercise.
9. Attach /paste separate papers wherever necessary.

Practical- Course Outcome matrix

Course Outcomes (COs):

- **a.** Determine various parameters used in electric circuit.
- **b.** Use of basic laws of electrical engineering.
- **c.** Make use of capacitor in different conditions.
- **d.** Use principles of magnetism.
- **e.** Use principles of electromagnetism.

S. No.	Practical Outcomes	CO a.	CO b.	CO c.	CO d.	CO e.
1.	Trace the layout of your electrical engineering laboratory: a. Draw layout of electrical laboratory. b. Prepare Charts of electrical safety and demonstrate the operation of fire extinguishing equipments. c. Demonstrate and use electric tools such as pliers, screw driver, insulation cutter, tester.	√	-	-	-	-
2.	Measure of e.m.f. of d.c. source and to calculate its internal resistance by connecting it to an external load. Part I	√	-	-	-	-
3.	Measure of e.m.f. of d.c. source and to calculate its internal resistance by connecting it to an external load. Part II	√	-	-	-	-
4.	Determine the equivalent resistance of Series connection.	√	√	-	-	-
5.	Determine the equivalent resistance of Parallel connection.	√	√	**-**	**-**	**-**
6.	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part I	**-**	√	**-**	**-**	**-**
7.	Use Kirchhoff's current law and Kirchhoff's voltage law to determine currents and voltages in electric circuits. Part II	**-**	√	**-**	**-**	**-**
8.	In the series connected circuits determine the equivalent capacitance.	**-**	**-**	√	**-**	**-**
9.	In the parallel connected circuits determine the equivalent capacitance.	**-**	**-**	√	**-**	**-**
10.	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor(C) through resistor (R). Part I	**-**	**-**	√	**-**	**-**

11.	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor(C) through resistor (R). Part II	-	-	√	-	-
12.	For the given magnetic material find the B-H curve and hysteresis loop. Part I	-	-	-	√	-
13.	For the given magnetic material find the B-H curve and hysteresis loop. Part II	-	-	-	√	-
14.	For the given magnetic material find the B-H curve and hysteresis loop. Part III	-	-	-	√	-
15.	Use Faraday's first law of electromagnetic induction to analyze the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part I	-	-	-	-	√
16.	Use Faraday's first law of electromagnetic induction to analyze the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part II	-	-	-	-	√

Content Page

List of Practicals and Progressive Assessment Sheet

11.	Determine the time constant of RC circuit analytically and graphically including plotting the charging and discharging curves of a capacitor(C) through resistor (R). Part II	50					
12.	For the given magnetic material find the B-H curve and hysteresis loop. Part I	57					
13.	For the given magnetic material find the B-H curve and hysteresis loop. Part II	63					
14.	For the given magnetic material find the B-H curve and hysteresis loop. Part III	69					
15.	Use Faraday's first law of electromagnetic induction to analyze the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part I	75					
16.	Use Faraday's first law of electromagnetic induction to analyze the behaviors of statically induced e.m.f. and Dynamically induced e.m.f. in the given circuit. Part II	80					
	Total Marks						

***** To be transferred to proforma of CIAAN-2017.

Practical No.1: Know your Laboratory

I PracticalSignificance

To know the various equipment and measuring instruments to perform the practical's effectively in electrical engineering.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basicengineering to solve the electrical engineering problems.

Experiments and practice: Plan to perform experiments and practices to use the resultsto solve electrical engineering problems.

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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams.

IV Relevant Course Outcome(s)

- Know various parameters, equipment and measuring instruments used in electrical circuit.

V Practical Outcome

Trace the layout of electrical engineering laboratory:

a. Draw a Single line diagram of electrical laboratory.

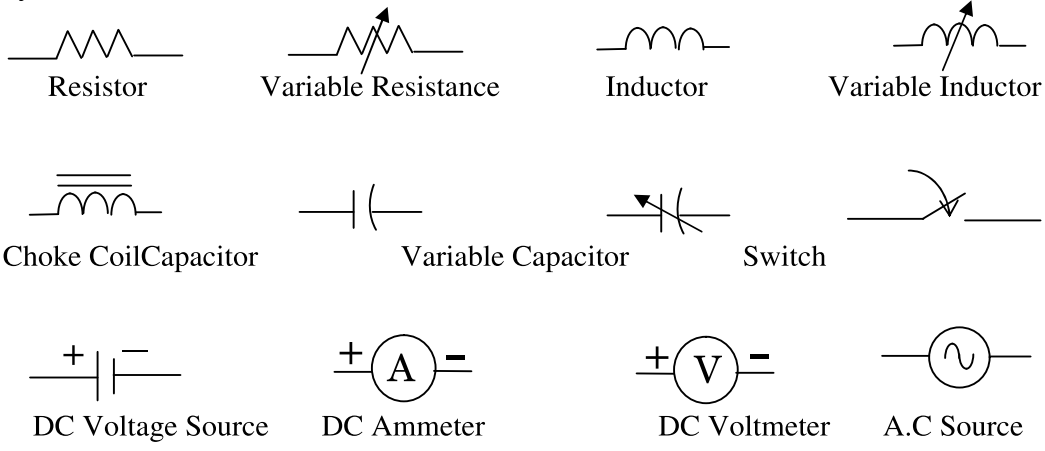
b. Prepare Charts of electrical safety and demonstrate the operation of fire extinguishing equipment.

c. Demonstrate and use electric tools such as pliers, screw driver, insulation cutter, tester.

VI Minimum Theoretical Background

Understand the different symbols used in electrical engineering related to supply, equipment and tools with their importance in electrical safety.

VII Symbols



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	Suitable EMF Source	1 No.
2	Voltmeter	Suitable voltage range	1 No.
3	Ammeter	Suitable current range	1 No.
4	Resistive load	Suitable load in ohm	1 No.

IX Precautions to be Followed

Follow Safety practices.

X Procedure

1. Know different types of equipment and measuring instruments in electrical engineering laboratory.
2. Observe electrical safety while working in laboratories.
3. Observe different charts available in the laboratory.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					
5.					

XII Actual Procedure Followed

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XIII Precautions Followed

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XIV Observations

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XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the names of emf sources available in market.
2. Give the different makes of ammeter, voltmeter and wattmeter.
3. List the various tools used in electrical engineering laboratory.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Understanding the importance of safety practices in the laboratory.	20%	
2	Understanding of various electrical equipment, measuring instruments and supply systems.	20%	
Product Related (15 Marks)		**60%**	
3	Applications of different tools and measuring instruments.	20%	
4	Conclusions	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(10)	**Product Related(15)**	**Total (25)**	

Practical No.2: D.C. Source E.M.F Measurement

I Practical Significance

D.C. Source E.M.F Measurement with utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the emf.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

Determine various parameters used in electric circuit.

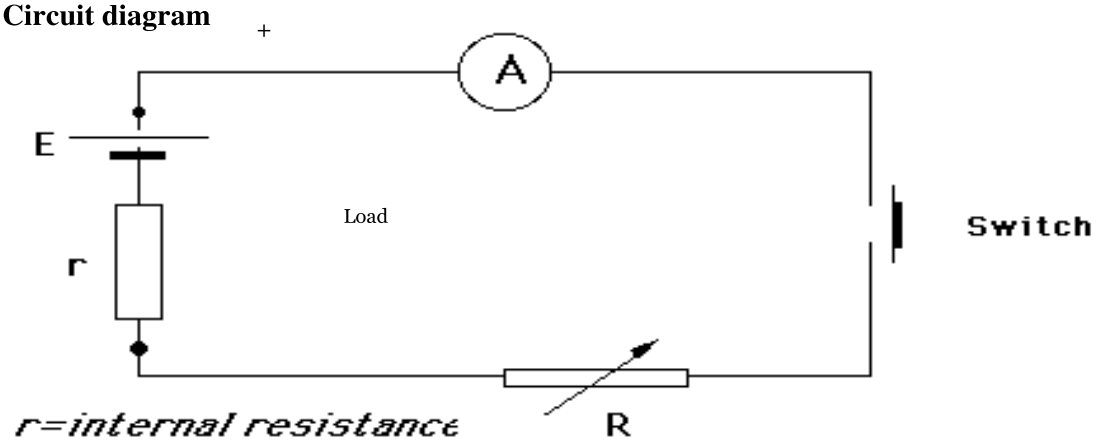
V Practical Outcome

Measure of e.m.f. of d.c. source

VI Minimum Theoretical Background

Voltmeter is an instrument used to measure emf and voltage of a battery.
The voltage source of which the magnitude & direction remain constant with respect to time is called as D.C. voltage source.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Resistive load	Suitable load in ohm	1 No.
5	Switch	Single pole single way witch (Knife switch)	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the relevant DC source as in circuit diagram
2. Select the relevant voltmeter, ammeter.
3. Connect as shown circuit diagram.
4. Switch on the DC supply.
5. Vary the rheostat for current change.
6. Record the voltmeter (V) and ammeter (I) readings in the observation table.
7. Determine the emf (E) and voltage.
8. Vary the load resistance
9. Repeat steps 5 to 8 for five more sets of readings.
10. Switch off the supply.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					
5.					

XII Actual Procedure Followed

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……

XIII Precautions Followed

1. ……
2. ……
3. ……
4. ……
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5. ……
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XIV Observations and Calculations

Sr. No.	E Volts	I Ampere	Terminal Voltage (Volt)
1			
2			
3			
4			
5			

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the names of emf sources available in market.
2. Give reasons for drop in voltage of a battery.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the ammeter and voltmeter	20%	
2	Determination of emf & voltage of cell	20%	
Product Related (15 Marks)		**60%**	
3	Interpretation of result	20%	
4	Conclusions	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(10)	**Product Related(15)**	**Total (25)**	

Practical No.3: D.C. Source Internal Resistance Measurement.

I Practical Significance

Measurement of internal resistance of D.C. sourcewith utmost accuracy and precision is a prime requirement. Such kinds of measurements are required to get better output voltage from the emf sources. In this practical we use voltmeter, ammeter to measure the internal resistance.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
Engineering Tools: Apply relevant electrical technologies and tools with an understanding of the limitations.

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III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use basic principles of electrical engineering in different applications'***:

i. Identify different types of supply sources, equipment and machines
ii. Interpret circuit diagrams

IV Relevant Course Outcome(s)

Determine various parameters used in electric circuit.

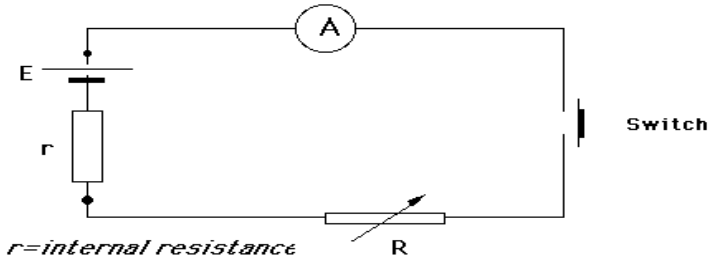
V Practical Outcome

Calculate internal resistance of Source by connecting it to an external load.

VI Minimum Theoretical Background

Battery and cells have an internal resistance (r) which is measured in Ohms. When electricity flows around a circuit the internal resistance of a DC source (cell) itself resist the flow of current and so thermal energy wasted in the cell itself.
$E = I*(R+r)$.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Resistive load	Suitable load in ohm	1 No.
5	Switch	One way switch	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the relevant DC source as in circuit diagram
2. Select the relevant voltmeter, ammeter and rheostat.
3. Connect as shown circuit diagram.
4. Switch on the DC supply.
5. Vary the rheostat for current change.
6. Record the voltmeter (V) and ammeter (I) readings in the observation table.
7. Determine the internal resistance (r) and voltage (V).
8. Repeat steps 5 to 7 for five more sets of readings.
9. Switch off the supply.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……

XIII Precautions Followed

1. ……
2. ……
3. ……

XIV Observations and Calculations

S.N.	E (volt)	I (ampere)	V (Volts)	Voltage drop across internal resistance r=(E-V)/I
1				
2				
3				
4				

XV Results

1. ……
2. ……
3. ……

XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the significance of internal resistance of a EMF source.
2. Give applications of storage batteries.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the ammeter and voltmeter	20%	
2	Determination of internal Resistance	20%	
Product Related (15 Marks)		**60%**	
3	Interpretation of result	20%	
4	Conclusions	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(10)	**Product Related(15)**	**Total (25)**	

Practical No. 4: Determine the Equivalent Resistance of Series Connection.

I Practical Significance

Determine the equivalent resistance of series connection with utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the series resistance.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines.
2. Interpret circuit diagrams.

IV Relevant Course Outcome(s)

- Use basic laws of electrical engineering.
- Determine various parameters used in electric circuit.

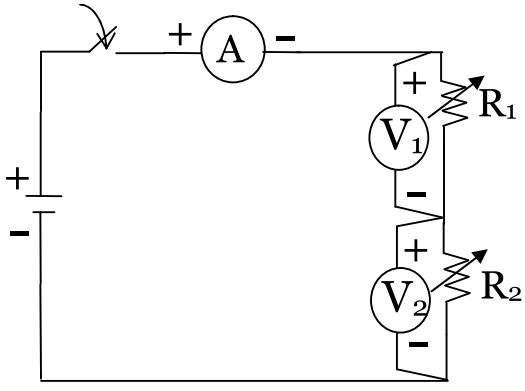
V Practical Outcome

Determine the equivalent resistance of Series connection.

VI Minimum Theoretical Background

Two or more elements are in series if they are cascaded or connected sequentially and consequently carry the same current. The equivalent resistances of any number of resistors connected in series is the sum of the individual resistances. The supply voltage is distributed across the resistances connected in series in proportion to their values. The series equivalent resistance is always greater than all individual resistances connected in series.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2.	Voltmeter	Suitable voltage	2 No.
3.	Ammeter	Suitable current	1 No.
4.	Series resistance	Suitable resistance in ohm	2 No.

XI Precautions to be followed

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

X Procedure

1. Select the relevant DC source as in circuit diagram
2. Select the relevant voltmeter, ammeter.
3. Connect as shown in circuit diagram.
4. Switch on the DC supply.
5. Vary the rheostat for current change.
6. Record the voltmeter (V) and ammeter (I) readings in the observation table.
7. Determine the voltage across resistance R1 and R2.
8. Determine the current flowing in resistance R1 and R2.
9. Repeat steps 5 to 8 for five more sets of readings maintaining supply voltage constant.
10. Calculate equivalent resistance.
11. Switch off the supply.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……
3. ……
4. ……
5. ……
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7. ……
8. ……
9. ……
10. ……

XIII Precautions Followed

1. ……
2. ……
3. ……
4. ……
5. ……

XI Observations and Calculations

S. No.	V1 Volts	I Ampere	R1=V1/I (ohm)	V2 Volts	R2=V2/I (ohm)	RT=R1+R2 (ohm)
1						
2						
3						
4						

X Results

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XI Interpretation of Results (Giving meaning to the results)

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

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XIII 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. Give the values of resistances available in laboratory.
2. Give applications of Series resistance.

[Space for answers]

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IX References / Suggestions for Further Reading

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

XX Assessment Scheme

	Performance Indicators	Weightage	Marks obtained
	Process Related (10 Marks)	**40%**	
1	Handling of the instrument	10%	
2	Determination of voltage of a circuit	10%	
3	Determination of Series resistance	20%	
	Product Related (15 Marks)	**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No.5: Determine the Equivalent Resistance of Parallel Connection.

I Practical Significance

Measurement of equivalent resistance of parallelconnection with utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the parallel resistance.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

- Use of basic laws of electrical engineering.
- Determine various parameters used in electric circuit

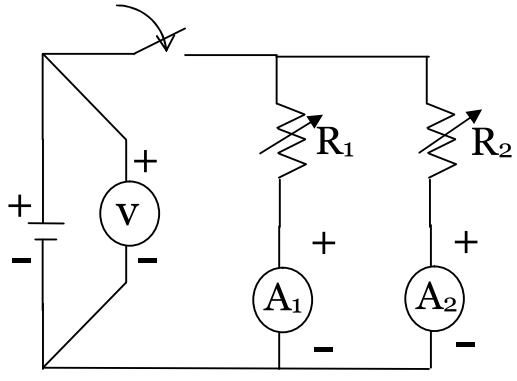
V Practical Outcome

Determine the equivalent resistance of parallel connection.

VI Minimum Theoretical Background

Two or more elements like resistances are in parallel if they are connected to the same two nodes and consequently have the same voltage across them. The parallel connected elements have the same voltage across them. The supply current is equal to sum of currents of all branches of parallel circuit. The parallel equivalent resistance is always less than all individual resistance of each branch.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	2 No.
4	Resistance	Suitable resistance in ohm	2 No.

IX Precautions to be Followed

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

X Procedure

1. Select the relevant DC source as in circuit diagram.
2. Select the relevant voltmeter, ammeter.
3. Connect as shown in circuit diagram.
4. Switch on the DC supply.
5. Record the voltmeter (V) and ammeter (I) readings in the observation table.
6. Determine the voltage across resistance R1 and R2.
7. Determine the current flowing in resistance R1 and R2.
8. Repeat steps 5 to 8 for five more sets of readings maintaining supply voltage constant.
9. Calculate equivalent resistance.
10. Switch off the supply.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……..

XIII Precautions Followed

1. ……
2. ……
3. ……
4. ……

XIV Observations and Calculations

S. No.	V Volts	I1 Ampere	R1=V/I1 (ohm)	I2 Ampere	R2=V/I2 (ohm)	RT=(R1*R2)/(R1+R2) (ohm)
1						
2						
3						
4						

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the types of parallelresistance available in market.
2. Give applications of parallelresistance.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	10%	
2	Determination of current of the circuit	10%	
3	Determination of Parallel resistance	20%	
Product Related (15 Marks)		**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No. 6: Use Kirchhoff's Current Law to Determine Currents in Electric Circuits. Part-I.

I Practical Significance

Use Kirchhoff's current law to determine currents in electric circuitswith utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc.

II Relevant Program Outcomes (POs)

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

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

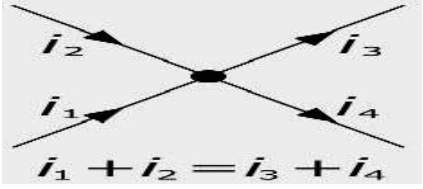
Use of basic laws of electrical engineering.

V Practical Outcome

Use Kirchhoff's current law to determine currents in electric circuits. Part I

VI Minimum Theoretical Background

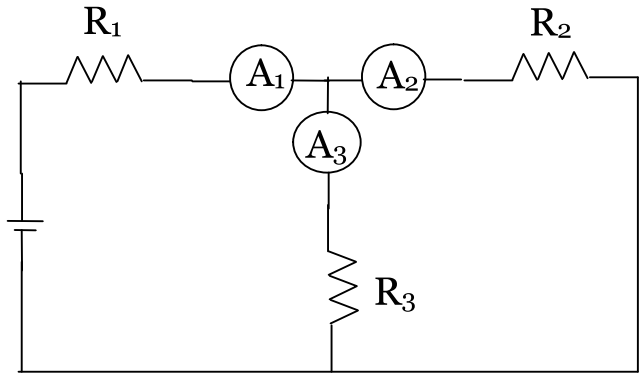
Kirchhoff's current law states that "in any electrical network, algebraic sum of the currents meeting a point is zero". In another way, it simply means that the total current leaving a junction is equal to the total current entering that junction. It is obviously true because there is no accumulation or depletion of current at any junction of the network.
Consider the case of a few current carrying conductors meeting at a node as shown in fig.



Some conductors have currents leading to node whereas some have currents leading away from node.
Assuming the incoming currents to be positive and the outgoing currents negative, applying KCL at node we have,

$$I_1 + I_2 - I_3 - I_4 = 0$$

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Ammeter	Suitable current	3 No.
3	Resistance	Suitable in ohm	3 No.

IX Precautions to be Followed

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

X Procedure

1. Measure & record the value of each rheostat in circuit diagram.
2. Measure the list count of all ammeters A1, A2 & A3.
3. Connect the circuit as shown in thediagram.
4. Switch on the DC supply & record the readings of ammeters.
5. Switch of the DC supply.

XI Resources Used

Sr. No	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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XIII Precautions Followed

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XIV Observations and Calculations

Sr.No.	A1 in (Amp)	A2 in (Amp)	A3 in (Amp)	$A_1=\frac{A_2+A_3}{4}$
1				
2				
3				

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the applications of KCL.

(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 Assessment Scheme

	Performance Indicators	Weightage	Marks obtained
	Process Related (10 Marks)	**40%**	
1	Handling of the Ammeter, voltmeter and rheostat.	10%	
2	Determination of branch currents	10%	
3	Application of KCL	20%	
	Product Related (15 Marks)	**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No. 7: Use Kirchhoff's Voltage Law to Determine Voltages in Electric Circuits. Part- II.

I Practical Significance

Use Kirchhoff's voltage law to determine voltages in electric circuitswith utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc.

II Relevant Program Outcomes (POs)

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

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

III Competency and Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use of basic laws of electrical engineering.

V Practical Outcome

Use Kirchhoff's voltage law to determine voltages in electric circuits.

VI Minimum Theoretical Background

Kirchhoff's voltage law states that **"**the algebraic sum of products of currents and resistances in each of the conductors in any closed path in a network plus the algebraic sum of the e.m.fs in that path iszero".

In other words, $\sum IR + \sum e.m.f. = 0$—around a closed path.

Following sign conventionsare suggested:

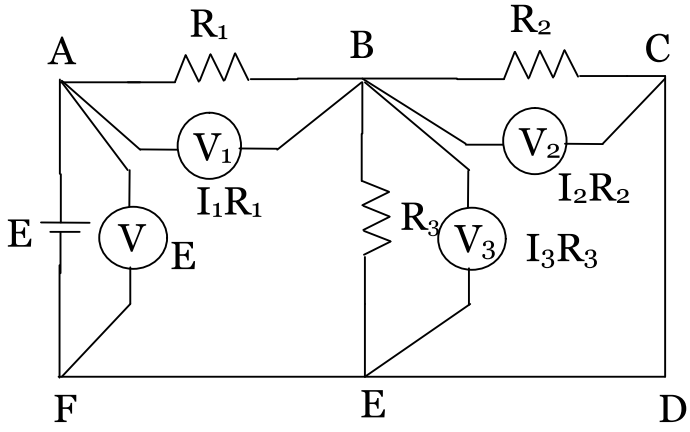
Sign Conventions

a) Battery e.m.f.:

A rise in voltage should be given a + ve sign and a fall in voltage a –ve sign. Keeping this in mind, it is clear that as we move from negative terminal of source to positive terminal, there is a rise in potential, hence this voltage should be given a +ve sign. If, on the other hand, we move from +ve terminal to –ve terminal of voltage source, then there is a fall in potential, hence it is to be considered as –ve.

Sign of IR Drop: Whenever we move in the direction of current there is a drop in voltage,Since the current always flows from point at higher potential to the point at lower potential. Hence Voltage drop in the current direction is taken as –ve. However, if we go in a direction opposite to that of the current, then there is a rise in voltage, hence it is to be considered as positive.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2.	Voltmeter	Suitable voltage	4 No.
3.	Resistances	Suitable resistance in ohm	3 No.

IX Precautions to be Followed

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

X Procedure

1. Measure & record the value of each rheostat in circuit diagram.
2. Measure the list count of all voltmeters.
3. Connect the circuit as shown in thediagram.
4. Switch on the DC supply & record the readings of voltmeters.
5. Switch of the DC supply.

XI Resources Used

Sr. No	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1					
2					
3					
4					

XII Actual Procedure Followed

1. ……

2. ……

XIII Precautions Followed

1. ……

2. ……

XIV Observations and Calculations

S. No.	$V1$ in (Volts) I_1R_1 1	$V2$ in (Volts) I_2R_2	$V3$ in (Volts) I_3R_3	E
1				
2				
3				

Calculations

For Loop 1:

For Loop 2:

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give applications of KVL.

(**Space for Answer**)

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XVIII References / Suggestions for Further Reading

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

XIX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	10%	
2	Determination of branch voltages	10%	
3	Determination of loop voltages	20%	
Product Related (15 Marks)		**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No. 8: In the Series Connected Circuits Determine the Equivalent Capacitance.

I Practical Significance

In industries, measurement of equivalent capacitancewith precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the equivalent capacitance.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams.

IV Relevant Course Outcome(s)

Make use of capacitor in different conditions.

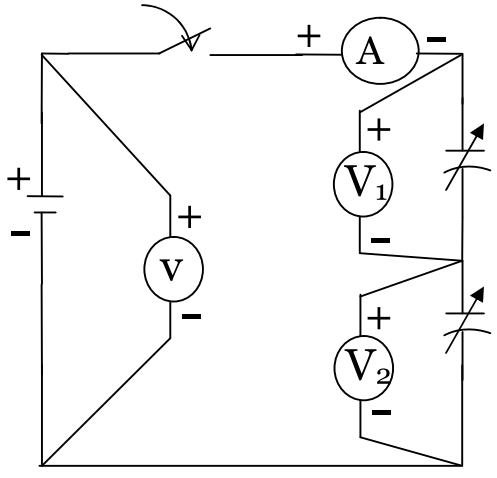
V Practical Outcome

In the series connected circuits determine the equivalent capacitance.

VI Minimum Theoretical Background

The equivalent capacitance of series connected capacitors is the reciprocal of the sum of the reciprocals of the individual capacitors. In series circuit charge is common. The supply voltage is distributed across the capacitors connected in series. The total capacitance of the capacitors in series is less than the capacitance of any of the individual capacitor.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	3 No.
3	Ammeter	Suitable current	1 No.
4	Capacitor	Suitable capacitor in farad	2 No.
5	Switch	One way switch	1 No.

IX Precautions to be Followed

1. Avoid loose connections
2. Don't touch wire with wet hand.
3. Discharge all capacitors completely before connecting in Circuit.

X Procedure

1. Read the value of each capacitor and record them before connecting in series.
2. Connect as per circuit diagram
3. Switch ON the supply, take readings of ammeters and measure voltage across each capacitors and supply voltage.
4. Switch OFF the supply.
5. Determine the Series equivalent capacitance.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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XIII Precautions Followed

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XIV Observations and Calculations

C1 = ---------- µF, C2 = ---------- µF

S. N.	*V*in (Volts)	*V1*in (Volts)	*V2*in (Volts)	I (mA)
1				
2				
3				

V= V1+V2
Q= C_T V
C_T = ---------- µF

XV Results

1. …….
2. …….
3. …….

XVI Interpretation of Results (Giving meaning to the results)

1. ……..……..…
2. ……..……..…
3. ……..…

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

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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. Two capacitances of 5 µF and 7 µF are connected in series find their equivalent capacitance.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	10%	
2	Determination of current and voltage	10%	
3	Determination of series capacitance	20%	
Product Related (15 Marks)		**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No.9: In the Parallel Connected Circuits Determine the Equivalent Capacitance.

I Practical Significance

In industries, measurement of Parallelcapacitancewith utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the equivalent capacitance.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use of capacitor in different conditions.

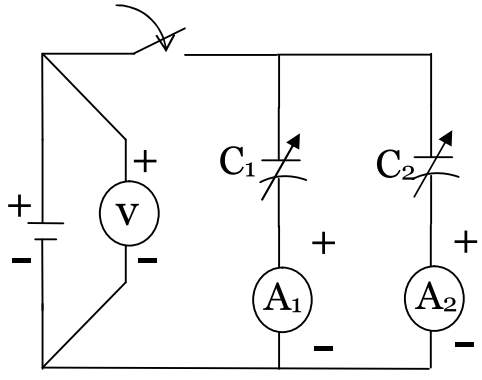
V Practical Outcome

In the parallel connected circuits determines the equivalent capacitance

VI Minimum Theoretical Background

The equivalent capacitance of N parallel connected capacitors is the sum of all individualcapacitance. The total charge is equal to sum of charges on each capacitor connected in parallel.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	2 No.
4	Capacitor	Suitable capacitor in farad	2 No.

IX Precautions to be Followed

1. Avoid loose connections
2. Don't touch wire with wet hand.
3. Discharge all capacitors completely before connecting in the circuit.

X Procedure

1. Read the value of capacitor and record them before connecting them in parallel.
2. Connect the capacitors in parallel along with meters as shown in circuit diagram.
3. Switch ON the supply and take readings of ammeters and voltmeters.
4. Switch OFF the supply.
5. Determine the equivalent capacitor.

XI Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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XIII Precautions Followed

1. ……
2. ……..
3. ……..
4. ……..
5. ……..

XIV Observations and Calculations

C1 = ---------- µF, C2 = ---------- µF

V = V1=V2 --------- volts

Q = V(C1+C2)

CT = C1 + C2 = ---------- µF

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the types of capacitor available in market.
2. Give applications ofcapacitor.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	10%	
2	Determination of current & voltage of circuit	10%	
3	Determination of Parallelcapacitance	20%	
Product Related (15 Marks)		**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	

Practical No.10: Determine the Time Constant of RC CircuitAnalytically and Graphically by Plotting the Charging Curves of A Capacitor(C). (Part-I)

I Practical Significance

In industries, measurement of time constant of RC circuitwith utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the charging of capacitor.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1. Identify different types of supply sources, equipment and machines
2. Interpret circuit diagrams

IV Relevant Course Outcome(s)

Determine various parameters used in electric circuit.

V Practical Outcome

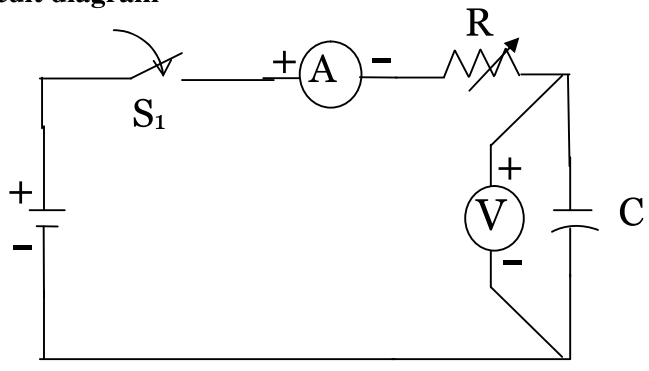
Use capacitor to:

i. Measure charging of capacitor.
ii. Plot the charging curve.
iii. To determine time constant.

VI Minimum Theoretical Background

When a DC voltage is applied across a series circuit containing a resistor and the capacitor, electrons flow towards one plate and away from other plate resulting in negative charge on one plate and positive charge on other plate, this process is called as charging of capacitor. The time required for the capacitor to get fully charged depends upon the values of resistance (R) and capacitance (C) of the circuit. It is the time in seconds during which the voltage across the capacitor reaches 63.2% of its final steady state maximum value i.e. $\tau = RC$.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1uA Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Capacitors	Suitable capacitor	1 No.
5	Resistance	Suitable resistance	1 No.
6	Stop watch	Suitable stop watch	1 No.
7	Switch	One way switch	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the resistance and capacitor.
2. Select the relevant voltmeter, ammeter.
3. Connect as per circuit diagram.
4. Determine the charging current.
5. Vary the resistance & measure the charging current.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……

XIII Precautions Followed

1. ……
2. ……
3. ……
4. ……
5. ……

Observations and Calculations

S.N.	Voltage across capacitor(volt)	Time(sec)	Charging current(uA)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Analytical: The time constant of RC circuit
R= ------- ohms. C=--------- μF. τ=RC=----------Seconds

Graphical: The time constant from charging curve is calculated as follows

i. Mark the point P on charging curve corresponding to 63.2% of final steady state voltage.
ii. From the marked point P draw perpendicular PQ on X axis
iii. From graph τ= --------- Seconds.

XIV Results

1. …….
2. ……
3. …….
4. …….

XV Interpretation of Results (Giving meaning to the results)

1. ……
2. ……
3. ……
4. ……

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

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XVII 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. Capacitor hold charge even when disconnected from the supply, justify.
2. Give applications of capacitor.

[Space for Answers]

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XVIII References / Suggestions for Further Reading

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

XIX Assessment Scheme

	Performance Indicators	Weightage	Marks obtained
	Process Related (10 Marks)	**40%**	
1	Handling of the ammeter, voltmeter, capacitor.	10%	
2	Determination of current & voltage of circuit	15%	
3	Determination of charging current, Time constant	15%	
	Product Related (15 Marks)	**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
6	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(10)	**Product Related(15)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No.11: Determine The Time Constant of RC Circuit Analytically and Graphically By Plotting The Discharging Curves of A Capacitor(C). (Part -II)

I Practical Significance

In industries, measurement of time constant of RC circuitwith utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the discharging of capacitor.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.

Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.

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 basic principles of electrical engineering in different applications'***:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams.
3 To determine time constant

IV Relevant Course Outcome(s)

Determine various parameters used in electric circuit.

V Practical Outcome

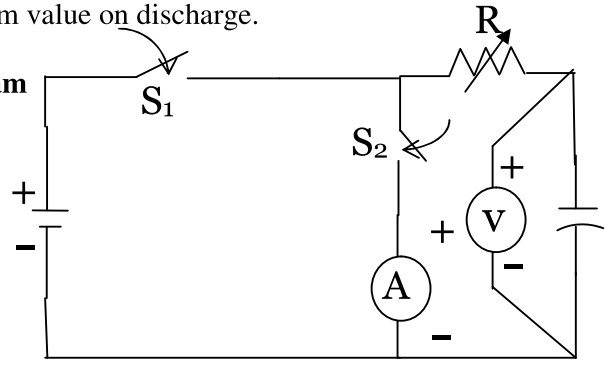
Use capacitor to:

1. Measure discharging of capacitor.
2. Plot the discharging curve.
3. To determine Time constant.

VI Minimum Theoretical Background

When an electrical load is connected across a charged capacitor, flow of electrons from negatively charged plate of capacitor through the load to the positively charge plates of a capacitor, thus eliminating charges on the plates is known as discharging of capacitor. Capacitor discharging leads to fall of voltage across the plates of capacitor. The time required for the capacitor to be fully discharged depends on the values of resistance and capacitance. The product RC i.e. time constant of the discharging circuit is the time required in seconds in which the voltage across the capacitor falls to 0.368 of its initial maximum value on discharge.

VII Circuit diagram



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1uA Voltage=0-20V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Capacitors	Suitable capacitor	1 No.
5	Resistance	Suitable resistance	1 No.
6	Stop watch	Suitable stop watch	1 No.
7	Switch	Single pole one way switch	2 No.

IX Precautions to be followed

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

X Procedure

1. Select the resistance and capacitor.
2. Select the relevant voltmeter, ammeter.
3. Connect as per circuit diagram.
4. Determine the discharging current.
5. Vary the resistance & measure the discharging current.

XI Resources Used

Sr. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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XIII Precautions Followed

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……

XIV Observations and Calculations

S.N.	Voltage across capacitor(volt)	Time(sec)	Discharging current(uA)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Calculations-

Analytical: The time constant of RC circuit
R= ------- ohms. C=--------- μF. τ=RC=----------Seconds

Graphical: The time constant from discharging curve is calculated as follows:

i. Mark the point S on charging curve corresponding to 36.8% of initial maximum value of voltage.
ii. From the marked point S draw perpendicular on X axis.
iii. The point T is on the X axis indicates time constant.
iv. From graph τ= --------- Seconds.

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XV Results

1. ……..
2. ……..
3. ……..
4. ……..
5. ……..

XVI Interpretation of Results (Giving meaning to the results)

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

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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. Ammeter connections are to be reverse while taking reading of discharging current justify.
2. Give applications of capacitor.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the ammeter, voltmeter, capacitor.	10%	
2	Determination of current & voltage of circuit	20%	
3	Determination of discharging current and time constant	20%	
Product Related (15 Marks)		**60%**	
4	Interpretation of result	20%	
5	Conclusions	20%	
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(10)	**Product Related(15)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 12: Plot B-H curve for the given magnetic Material.Part I.

I Practical Significance

In industries, measurement of B-H curve is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the B-H curve.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use principle of electromagnetism.

V Practical Outcome

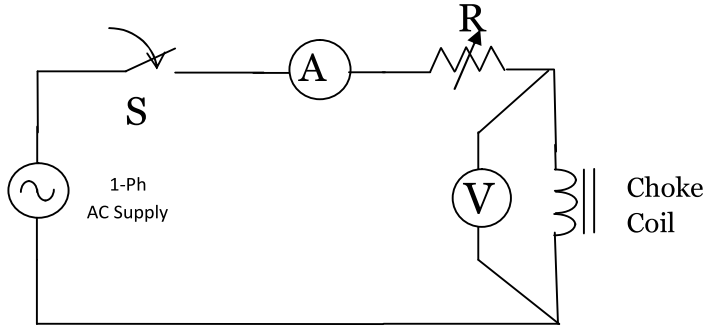
Use magnetic material to:

1. Measure flux density (B) and magnetizing force(H).
2. Plot the B-H curve.

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.

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	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Inductive coil	Suitable inductor	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the inductive coil.
2. Select the relevant voltmeter, ammeter.
3. Connect the circuit as per circuit diagram.
4. Vary the resistance, measure the current and voltage.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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XIII Precautions Followed

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XIV Observations and Calculations

S.N.	VOLTAGE (V) (volt)	CURRENT(I)(ampere)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10		
11		

12		
13		
14		
15		

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. Give the significance of magnetization curve.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

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


Scale
X-axis -
Y-axis -

Practical No. 13: For the given Magnetic Material Find Hysteresis Loop.Part II.

I Practical Significance

In industries, measurement of Hysteresis loop with utmost prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the Hysteresis loop.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.

Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.

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 basic principles of electrical engineering in different applications'**:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use principle of electromagnetism.

V Practical Outcome

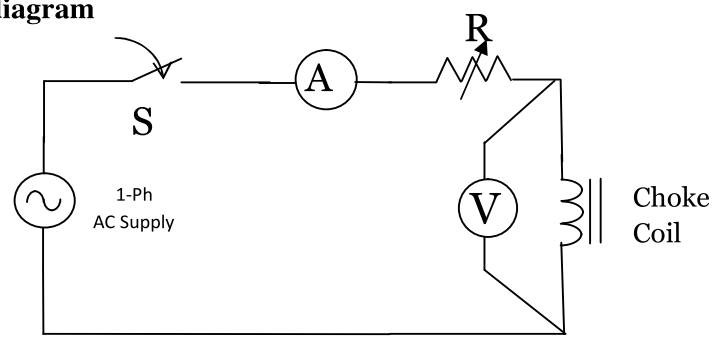
Use magnetic material to:

i. Measure flux density (B) and magnetizing force(H).
ii. Plot the Hysteresis loop

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 = μH, where μ is called as absolute permeability of magnetic material.Magnetic hysteresis: lagging of magnetization or magnetic flux density (B) behind the magnetization force (H)is called as magnetic hysteresis.Hysteresis loop: Due to magnetic hysteresis, a closed loop is obtained when a magnetic material is taken through one complete cycle of magnetization, this loop is known as hysteresis loop

VII Circuit diagram



VIII Resources Required

Sr. No.	Name of Resource	Suggested Broad Specification	Quantity
1	EMF source	ampere=0-1A Voltage=0-300V	1 No.
2	Voltmeter	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Inductive coil	Suitable inductor	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the inductive coil.
2. Select the relevant voltmeter, ammeter.
3. Connect the circuit as per circuit diagram.
4. Vary the resistance, measure the current and voltage.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

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……...

XIII Precautions Followed

……..……
……..…….

XIV Observations and Calculations

S.N.	Volt(V) Increasing	Current (I) Increasing	Volt(V) Decreasing	Current(I) Decreasing
1				
2				
3				
4				
5				
6				
7				
8				
9				

10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

XV Results

1. ……
2. ……

XVI Interpretation of Results (Giving meaning to the results)

1. ……
2. ……

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

……
……

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. Draw nature of hysteresis loop for a nonmagnetic material.

[Space for Answers]

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XIX References / Suggestions for Further Reading

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

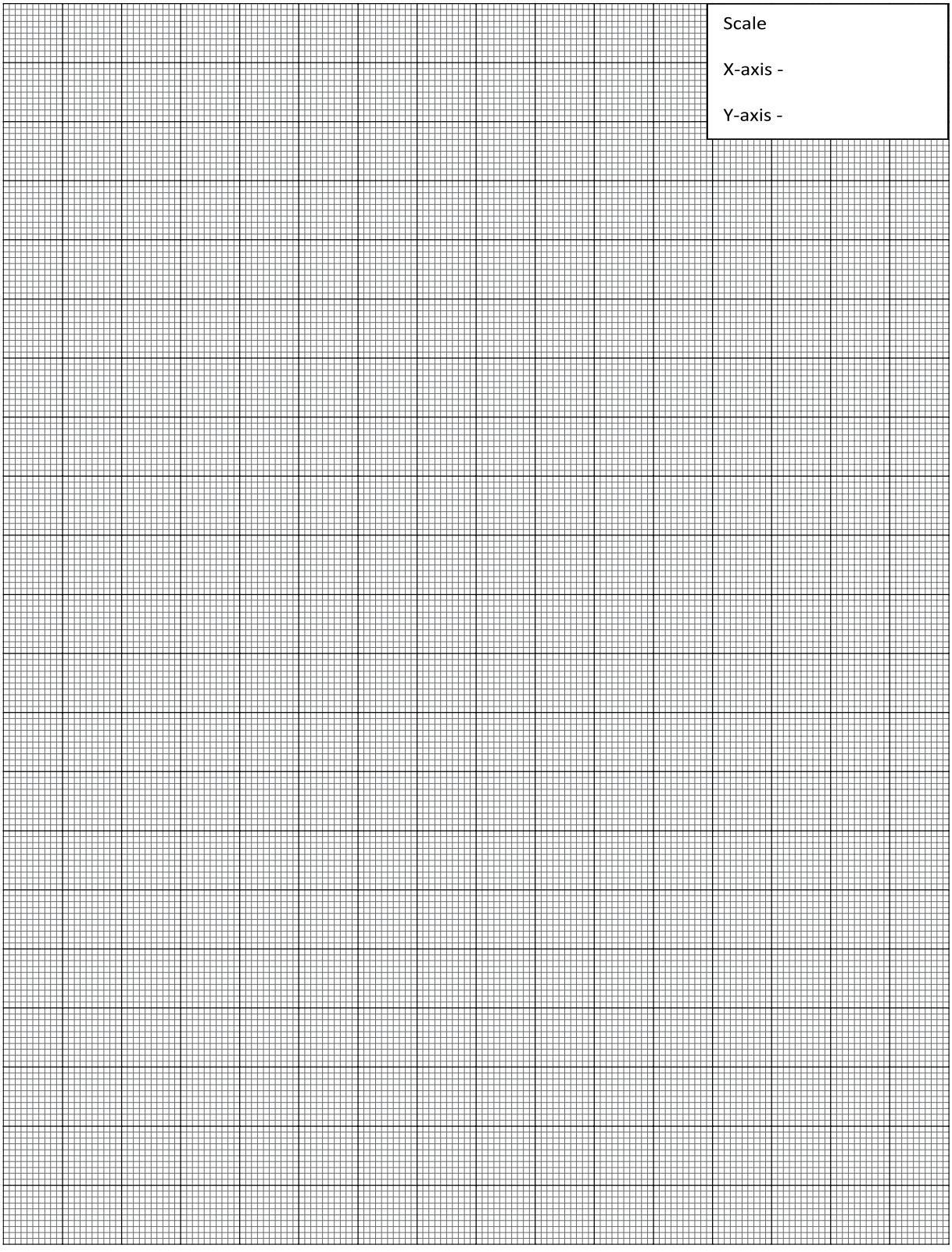
XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	20%	
2	Determination of current & voltage	20%	
Product Related (15 Marks)		**60%**	
3	Plot Hysteresis loop and interpretation of result	20%	
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(10)	**Product Related(15)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 14: For the Given Magnetic Material Find B-H Curve and Hysteresis Loop.Part -III.

I Practical Significance

In industries, measurement of Hysteresis loop with is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the Hysteresis loop

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use principle of electromagnetism.

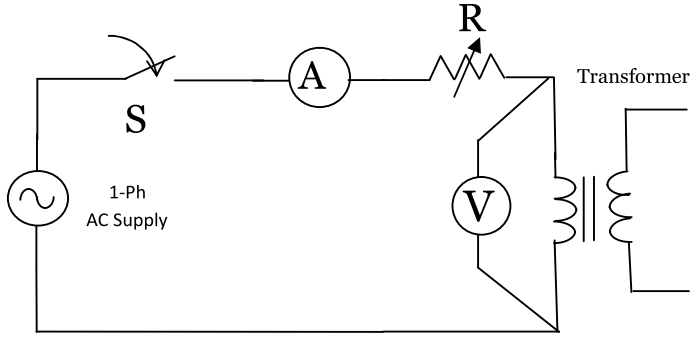
V Practical Outcome

Draw the B-H curve and Hysteresis loop for the given magnetic material.

VI Minimum Theoretical Background

Magnetic hysteresis: lagging of magnetization or magnetic flux density (B)behind the magnetization force(H)is called as magnetic hysteresis.
Hysteresis loop:Due to magnetic hysteresis, a closed loop is obtained when a magnetic material is taken through one complete cycle of magnetization, this loop is known as hysteresis loop.

VII Practical set-up



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	Suitable voltage	1 No.
3	Ammeter	Suitable current	1 No.
4	Transformer(0.5/1kVA)	Suitable transformer	1 No.

IX Precautions to be Followed

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

X Procedure

1. Select the transformer.
2. Select the relevant voltmeter, ammeter.
3. Connect the circuit as per circuit diagram.
4. Vary the voltage, measure the current and voltage.
5. Plot B-H curve and hysteresis loop.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……

XIII Precautions Followed

1. ……
2. ……

XIV Observations and Calculations

S.N.	Voltage(V) Increasing	Current(I) Increasing	Voltage(V) Decreasing	Current(I) Decreasing
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

9.				
10.				
11.				
12.				
13.				
14.				
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16.				
17.				
18.				
19.				
20.				

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

……..…….……
……...…….……

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

……..…...…….……..……
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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. State the different materials used for the core of transformer.

[Space for Answers]

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IX References / Suggestions for Further Reading

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

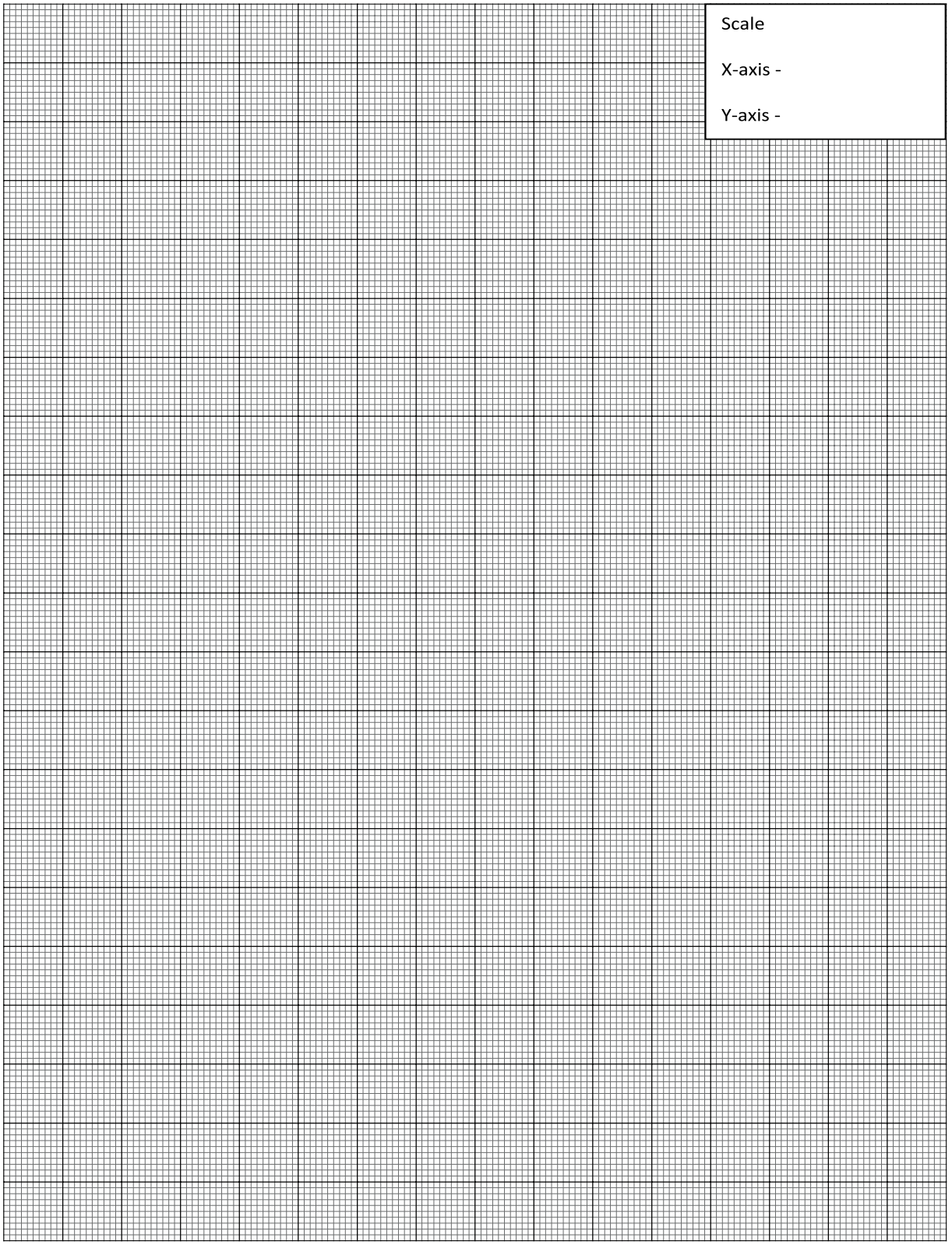
XX Assessment Scheme

Performance Indicators		Weightage	Marks obtained
Process Related (10 Marks)		**40%**	
1	Handling of the instrument	20%	
2	Determination of current & voltage	20%	
Product Related (15 Marks)		**60%**	
3	Plot hysteresis loop and interpretation of result	20%	
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(10)	**Product Related(15)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 15: Use Faraday's First Law of Electromagnetic Induction to Analyze the Behaviors of Statically Induced emf. (Part I.)

I Practical Significance

In industries, measurement of static emf with utmost accuracy and precision is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the static induced emf.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams

IV Relevant Course Outcome(s)

- Use principle of electromagnetism.

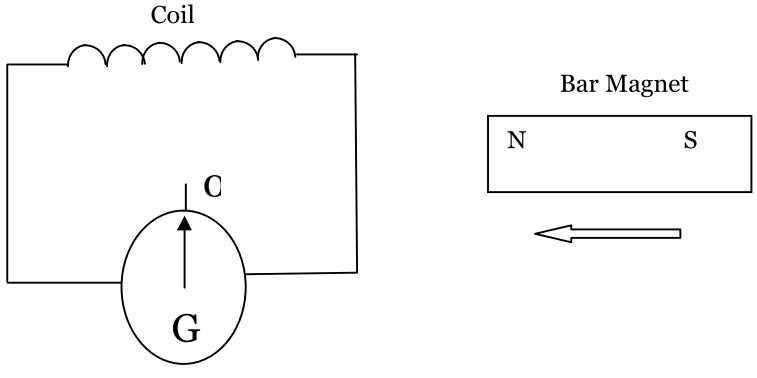
V Practical Outcome

Use Faraday's first law of electromagnetic induction to analyze the behavior of statically induced emf.

VI Minimum Theoretical Background

Whenever a conductor cuts magnetic flux an emf is induced in the conductor. Or whenever magnetic flux linking with the conductor/coil changes, an emf is always induced in it.

VII Work-Field Situation



VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Bar Magnet	Bar Magnet of known Polarity	1 No.
2	Galvanometer	Suitable range	1 No.
3	Inductive coil	Contactor coil or any suitable coil having large no. of turns.	1 No.

IX Precautions to be Followed

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

X Procedure

1. Connect two ends of the coil to the Galvanometer.
2. Take a bar magnet of known polarity.
3. Move the bar magnet in the coil as per the sequence given in observation table.
4. Observe the deflection of Galvanometer.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					
5.					

XII Actual Procedure Followed

1. ……
2. ……
3. ……

XIII Precautions Followed

1. ……
2. ……

XIV Observations and Calculations

S.N.	Movement of Bar Magnet	Movement of The Magnet	Deflection of Galvanometer Connected Across Coil	
			Forward/Reverse	Less/More
1	Towards the coil	Slow		
2	Towards the coil	Fast		
3	Away from the coil	Slow		
4	Away from the coil	Fast		

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. State Lenz's Law.

Space for Answers

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XIX References / Suggestions for Further Reading

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

XX Assessment Scheme

	Performance Indicators	Weightage	Marks obtained
	Process Related (10 Marks)	**40%**	
1	Handling of the instrument	20%	
2	Determination of deflection of Galvanometer	20%	
	Product Related (15 Marks)	**60%**	
3	Interpretation of result	20%	
4	Conclusions	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(10)	**Product Related(15)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 16: Use Faraday's First Law of Electromagnetic Induction to Analyze the Behaviors of Dynamically Induced emf in the given Circuit.Part II.

I Practical Significance

In industries, measurement of dynamic emf with is a prime requirement. Such kind of measurements are possible using measuring instruments like voltmeter, ammeter etc. In this practical we use voltmeter, ammeter to measure the dynamic induced emf.

II Relevant Program Outcomes (POs)

Discipline knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the electrical engineering problems.
Experiments and practice: Plan to perform experiments and practices to use the results to solve electrical engineering problems.
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 basic principles of electrical engineering in different applications'***:

1 Identify different types of supply sources, equipment and machines
2 Interpret circuit diagrams

IV Relevant Course Outcome(s)

Use principle of electromagnetism.

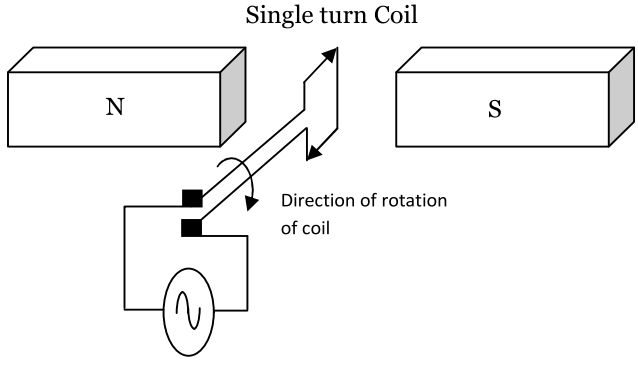
V Practical Outcome

Use Faraday's first law of electromagnetic induction to analyze the behaviors of statically induced emf and dynamically induced emfin the given circuit.Part II.

VI Minimum Theoretical Background

Whenever a conductor cuts magnetic flux an emf is induced in the conductor. Or whenever magnetic flux liking with the conductor/coil changes, an emf is always induced in it

VII Work-Field Situation



Circuit Diagram:

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Bar Magnet	Bar magnet of Known polarity	1 No.
2	Galvanometer	Suitable range	1 No.
3	Inductive coil	Inductor Coils having large no. of turns.	1 No.

IX Precautions to be Followed

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

X Procedure

1. Connect two ends of the coil to the Galvanometer.
2. Take a bar magnet of known polarity.
3. Move the bar magnet in the coil as per the sequence given in observation table.
4. Observe the deflection of Galvanometer.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					
4.					

XII Actual Procedure Followed

1. ……
2. ……

XIII Precautions Followed

1. ……
2. ……

XIV Observations and Calculations

S.N.	Position of Magnet	Movement of Magnet	Deflection of Galvanometer	
			Forward/Reverse	Less/More
1	N-Pole towards the coil	Slow		
2	N-Pole towards the coil	Fast		
3	S-Pole towards the coil	Slow		
4	S-Pole towards the coil	Fast		

XV Results

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XVI Interpretation of Results (Giving meaning to the results)

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

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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. State Fleming's Right Hand Rule.

[Space for Answers]

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1	Handling of the instrument	20%	
2	Determination of deflection of Galvanometer	20%	
Product Related (15 Marks)		**60%**	
3	Interpretation of result	20%	
4	Conclusions	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(10)	**Product Related(15)**	**Total (25)**	

List Of Laboratory Manuals Developed by MSBTE

First Semester:

1	Fundamentals of ICT	22001
2	English	22101
3	English Work Book	22101W
4	Basic Science (Chemistry)	22102
5	Basic Science (Physics)	22102

Second Semester:

1	Bussiness Communication Using Computers	22009
2	Computer Peripherals & Hardware Maintenace	22013
3	Web Page Design with HTML	22014
4	Applied Science (Chemistry)	22202
5	Applied Science (Physics)	22202
6	Applied Machines	22203
7	Basic Surveying	22205
8	Applied Science (Chemistry)	22211
9	Applied Science (Physics)	22211
10	Fundamental of Electrical Engineering	22212
11	Elements of Electronics	22213
12	Elements of Electrical Engineering	22215
13	Basic Electronics	22216
14	'C' programming Language	22218
15	Basic Electronics	22225
16	Programming in "C"	22226
17	Fundamentals of Chemical Engineering	22231

Third Semester:

1	Applied Multimedia Techniques	22024
2	Advanced Serveying	22301
3	Highway Engineering	22302
4	Mechanics of Structures	22303
5	Building Construction	22304
6	Concrete Technology	22305
7	Strength Of Materials	22306
8	Automobile Engines	22308
9	Automobile Transmission System	22309
10	Mechanical Operations	22313
11	Technology Of Inorganic Chemicals	22314
12	Object Oriented Programming Using C++	22316
13	Data Structure Using 'C'	22317
14	Computer Graphics	22318
15	Database Management System	22319
16	Digital Techniques	22320
17	Principles Of Database	22321
18	Digital Techniques & Microprocessor	22323
19	Electrical Circuits	22324
20	Electrical & Electronic Measurment	22325
21	Fundamental Of Power Electronics	22326
22	Electrical Materials & Wiring Practice	22328
23	Applied Electronics	22329
24	Electrical Circuits & Networks	22330
25	Electronic Measurments & Instrumentation	22333
26	Principles Of Electronics Communication	22334
27	Thermal Engineering	22337
28	Engineering Matrology	22342
29	Mechanical Engineering Materials	22343
30	Theory Of Machines	22344

Fourth Semester:

1	Hydraulics	22401
2	Geo Technical Engineering	22404
3	Chemical Process Instrumentation & Control	22407
4	Fluid Flow Operation	22409
5	Technology Of Organic Chemicals	22410
6	Java Programming	22412
7	GUI Application Development Using VB.net	22034
8	Microprocessor	22415
9	Database Managment	22416
10	Electric Motors And Transformers	22418
11	Industrial Measurements	22420
12	Digital Electronics And Microcontroller Applications	22421
13	Linear Integrated Circuits	22423
14	Microcontroller & Applications	22426
15	Basic Power Electronics	22427
16	Digital Communication Systems	22428
17	Mechanical Engineering Measurments	22443
18	Fluid Mechanics and Machinery	22445
19	Fundamentals Of Mechatronics	22048
20	Guidelines & Assessment Manual for Micro Projects & Industrial Training	22049

Fifth Semester:

1	Network Management & Administration	17061
2	Solid Modeling	17063
3	CNC Machines	17064
4	Behavioral Science(Hand Book)	17075
5	Behavioral Science (Assignment Book)	17075
6	Windows Programming using VC++	17076
7	Estimation and Costing	17501
8	Public Health Engineering	17503
9	Concrete Technology	17504
10	Design of Steel Structures	17505
11	Switchgear and Protection	17508
12	Microprocessor & Application	17509
13	A.C. Machines	17511
14	Operating System	17512
15	Java Programming	17515
16	System Programming	17517
17	Communication Technology	17519
18	Hydraulic & Pneumatics	17522
19	Advanced Automobile Engines	17523
20	Basic Electrical & Electronics	17524
21	Measurement and Control	17528
22	Power Engineering	17529
23	Metrology & Quality Control	17530
24	Computer Hardware & Networking	17533
25	Microcontroller	17534
26	Digital Communication	17535
27	Control System & PLC	17536
28	Audio Video Engineering	17537
29	Control System	17538
30	Industrial Electronics and applications	17541
31	Heat Transfer Operations	17560
32	Chemical Process Instrumentation & control	17561

Sixth Semester:

1	Solid Modeling	17063
2	Highway Engineering	17602
3	Contracts & Accounts	17603
4	Design of R.C.C. Structures	17604
5	Industrial Fluid Power	17608
6	Design of Machine Elements	17610
7	Automotive Electrical and Electronic Systems	17617
8	Vehicle Systems Maintenance	17618
9	Software Testing	17624
10	Advanced Java Programming	17625
11	Mobile Computing	17632
12	System Programing	17634
13	Testing & Maintenance of Electrical Equipments	17637
14	Power Electronics	17638
15	Illumination Engineering	17639
16	Power System Operation & Control	17643
17	Environmental Technology	17646
18	Mass Transfer Operation	17648
19	Advanced Communication System	17656
20	Mobile Communication	17657
21	Embedded System	17658
22	Process Control System	17663
23	Industrial Automation	17664
24	Industrial Drives	17667
25	Video Engineering	17668
26	Optical Fiber & Mobile Communication	17669
27	Therapeutic Equipment	17671
28	Intensive Care Equipment	17672
29	Medical Imaging Equipment	17673

Pharmacy Lab Manual

First Year:

1	Pharmaceutics - I	0805
2	Pharmaceutical Chemistry - I	0806
3	Pharmacognosy	0807
4	Biochemistry and Clinical Pathology	0808
5	Human Anatomy and Physiology	0809

Second Year:

1	Pharmaceutics - II	0811
2	Pharmaceutical Chemistry - II	0812
3	Pharmacology & Toxicology	0813
4	Hospital and Clinical Pharmacy	0816

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