RAJALAKSHMI ENGINEERING COLLEGE(AUTONOMOUS) THANDALAM – 602 105.

DEPARTMENT OF EEE

EE 19241	**BASIC ELECTRICAL ENGINEERING LABORATORY**

NAME :

CLASS :

SEMESTER :

ROLL NUMBER :

VISION

- To be an institution of excellence in Engineering, Technology and Management education & Research.
- To provide competent and ethical professional with a concern for society.

MISSION

- To impart quality technical education imbibed with proficiency and human values.
- To provide right ambience and opportunities for the students to develop into creative, talented and globally competent professionals.
- To promote research and development in Technology and Management for the benefit of the society.

RAJALAKSHMI ENGINEERING COLLEGE

THANDALAM, CHENNAI – 602 105.

An Autonomous Institution Affiliated to Anna University, Chennai

Approved by AICTE, Accredited By NBA & NAAC ISO 9001: 2008 CERTIFIED

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT VISION AND MISSION

VISION

- To be an international centre in education, research and the application of knowledge, to benefit the society globally in the field of Electrical and Electronics Engineering.

MISSION

- To impart high quality technical education and develop Electrical and Electronics Engineers with a sound theoretical combined with practical skills in all the areas concerning the discipline.
- To inculcate innovative research capabilities and exemplary professional conduct to lead and to use technology for the progress of our country.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To provide students with a strong foundation in mathematics, science and engineering, necessary to understand and solve engineering problems. Prepare the students for a successful career in industries and also for higher studies.
2. To enable the students to acquire the ability to analyze, design and build electrical and electronic systems, needed in power electronic drives, variety of controllers, and power systems.
3. To impart students with a sound knowledge of software tools and skills for taking up research in upcoming areas in the field of electrical and electronics engineering, and for embarking on entrepreneurial ventures with an aptitude for lifelong learning.
4. To impart communication skills, to inculcate values and professional ethics, leadership qualities and team spirit for an overall personality development, to create environmental awareness and a passion for using the knowledge acquired, for addressing the societal concerns.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and search methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Analyze, model and design Electrical and Electronic circuits and machines**.**
PSO 2. Comprehend the structure of power apparatus and systems and analyze their operation, control, protection and utilization**.**
PSO 3. Use of programmable devices, embedded systems and software tools for the simulation, design and building newer electrical and electronic systems leading to research and invention.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To produce globally competent Electronics and Communication Engineers with a commitment to serve the society.

MISSION

M1 To impart training with the best of teaching expertise supported by excellent laboratory infrastructure and exposure to recent trends in the industry.

M2 To ensure that the students are molded into competent Electronics and Communication engineers with the knowledge of computer applications and worthy citizens of the country.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO I To provide students with sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to prepare them for post graduate studies and for successful careers in industries.

PEO II To develop the ability among students to define engineering problems in the fields of electronics and Communication engineering, and to employ necessary techniques, hardware, and communication tools for modern Engineering applications.

PEO III To instil the values, skills, leadership and team spirit for comprehensive and wholesome personality, to promote entrepreneurial interest among students and to create a fervor for use of Engineering in addressing societal concerns.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: An ability to formulate solutions for practical societal requirements using communication engineering.

PSO2: To design and formulate solutions for industrial requirements using Electronics and Communication engineering.

PSO3: To understand and develop solutions required in multidisciplinary engineering fields.

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DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To provide a world class Mechanical Engineering education through innovation and excellence in Teaching and Research.

MISSION

M1.To impart high quality technical education and prepare Mechanical Engineers with all round knowledge of multi-disciplinary branches of Engineering and Technology.
M2.To foster skill sets required to be a global professional for industry, research and technology management.
M3.To provide consultancy to the neighborhood industries.
M4.To cultivate the spirit of entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To provide students with sound foundation in mathematical, scientific and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to prepare them for graduate studies and for successful careers in industry.

PEO 2: To impart the students with skill for design, improvement and installation of Mechanical and allied integrated system of men and material.

PEO 3: To educate the students on designing the modern mechanical system and expose them to industrial practices for better employability and adaptability.

PEO 4: To instill the values skill, leadership and team spirit for comprehensive and wholesome personality, to promote entrepreneurial interest among students and to create a fervor for use of engineering in addressing societal concerns.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To innovate a Mechanical System which meets the desired specifications and requirements using CAE tools.

PSO 2: To explore alternate materials for automobile, manufacturing and process industries.

PSO 3: To lead professional career in industries or an entrepreneur by applying Engineering and Management principles and practices.

SYLLABUS

EE19241 BASIC ELECTRICAL ENGINEERING LABORATORY

LIST OF EXPERIMENTS

1. Experimental verification of Kirchhoff's voltage and current laws
2. (i)Experimental verification of network Thevenin's theorem
   (ii)Experimental verification of network Norton's theorem
3. Load test on DC shunt motor.
4. Speed control of DC shunt motor.
5. Load test on single-phase transformer.
6. Open circuit and short circuit tests on single phase transformer.
7. Speed control of chopper fed DC motor.
8. Speed control of 3Φ Induction motor.

CYCLE I

1. Experimental verification of Kirchhoff's voltage and current laws
2. (i)Experimental verification of network Thevenin's theorem.(ii)Experimental verification of network Norton's theorem
3. Load test on DC shunt motor.
4. Speed control of DC shunt motor.

CYCLE II

5. Load test on single-phase transformer.
6. Open circuit and short circuit tests on single phase transformer.
7. Speed control of chopper fed DC motor.
8. Speed control of 3Φ Induction motor

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	3	3	1	1	-	-	-	-	2	1	-	1
CO 2	3	3	2	3	3	1	1	-	-	-	-	-	1	-	1
CO 3	3	3	2	3	3	2	2	-	1	-	-	2	3	-	2
CO 4	3	3	2	3	3	2	2	-	-	-	2	2	1	-	1
CO 5	3	3	2	3	3	1	2	1	1	1	2	2	2	-	1
Average	3	3	2	3	3	1.4	1.6	1	1	1	2	2	1.6	-	1.2

INDEX

S. No.	Date	Title of Experiment	Page no.	Marks	Signature
1		Experimental verification of Kirchhoff's voltage and current			
2		Experimental verification of network - Thevenin's theorem			
3		Experimental verification of network - Norton's theorem			
4		Load test on DC shunt motor			
5		Speed control of DC Shunt motor			
6		Load test on single-phase transformer			
7		Open circuit and short circuit tests on single phase transformer			
8		Speed control of chopper fed DC motor			
9		Speed control of 3Φ Induction motor			

EXP. NO: **DATE:**

VERIFICATION OF KIRCHHOFF'S LAWS

AIM:

To verify the Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL) theoretically and practically of the given network.

STATEMENT:

KIRCHHOFF'S CURRENT LAW-

Kirchhoff's current law (KCL) states that the algebraic sum of all currents at a node is zero.

KIRCHHOFF'S VOLTAGE LAW-

Kirchhoff's voltage law (KVL) states that the algebraic sum of voltage drop is equal to the sum of voltage rise in any closed path (loop or mesh).

APPARATUS REQUIRED:

S.NO	APPARATUS	RANGE	TYPE	QTY
1.	DC Regulated power supply	(0-30) V	DC	1
2.	Bread Board	840 Tie Points	Solderless	1
3.	Ammeter	(0-50) mA	MC	3
4.	Voltmeter	(0-30) V	MC	3
5.	Resistor	220, 330 Ohms	-	2, 1
6.	Connecting wires	-	Single Stranded	As per requirement

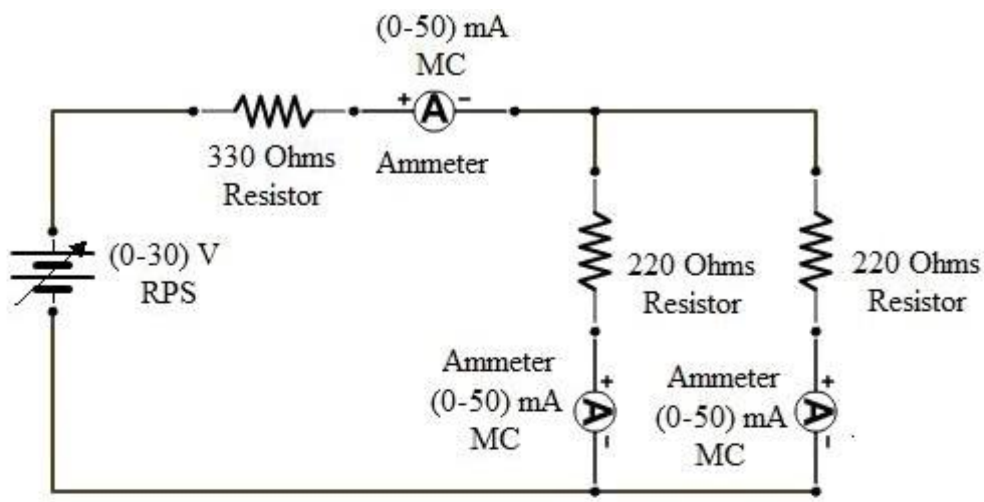
PROCEDURE:

KCL

1. Connections are made as per the circuit diagram.
2. Switch on the power supply.
3. Vary the RPS to a specified voltage and note down the corresponding ammeter readings.
4. Verify KCL for the nodes in the circuit.
5. Switch off the power supply and remove the connections.

CIRCUIT DIAGRAM:

KIRCHOFF'S CURRENT LAW-



TABULATION:

S. No	Applied voltage in Volts	Measured Current in mA			Total current $I_1 = I_2 + I_3$ in mA (Practical Value)	Total current $I_1 = I_2 + I_3$ in mA (Theoretical Value)
		I_1	I_2	I_3		
1	**15 V**					
2	**20 V**					

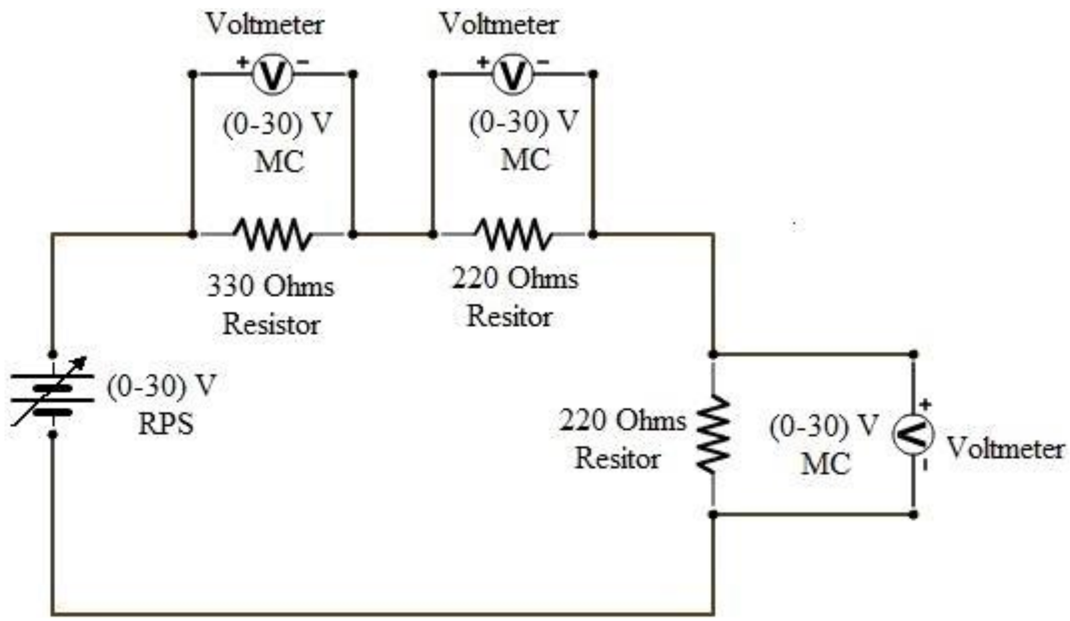
THEORITICAL CALCULATION:

KVL-

1. Connections are made as per the circuit diagram
2. Switch on the power supply.
3. Vary the RPS to a specified voltage and note down the corresponding voltmeter readings.
4. Verify KVL for the loops in the circuit.
5. Switch off the power supply and remove the connections.

CIRCUIT DIAGRAM:

KIRCHHOFF'S VOLTAGE LAW:



TABULATION:

S. No	Applied voltage in Volts	Measured Voltage in volts			Total voltage $V_1 + V_2 + V_3$ in volts (Practical Value)	Total voltage $V_1 + V_2 + V_3$ in volts (Theoretical Value)
		V_1	V_2	V_3		
1.	20 V					
2.	25 V					

THEORETICAL CALCULATION:

VIVA QUESTIONS:

Q1. What is the sign convention to be followed while applying KCL?

Ans:

Q2. What is meant by potential rise and potential drop?

Ans:

Q3. Write the formula for KCL and KVL?

Ans:

Q4. What are the limitations and application of Kirchhoff's laws?

Ans:

REC		
DEPT. OF EEE		
	MAX MARKS	**OBT MARKS**
ATTENDANCE	**5**	
OBSERVATION	**5**	
RECORD	**5**	
VIVA	**5**	
TOTAL	**20**	

RESULT:

Thus the Kirchhoff's Current and voltage laws are verified theoretically and practically for the given circuit.

EXP. NO: **DATE :**

VERIFICATION OF THEVENIN'S THEOREM

AIM:

To verify Thevenin's theorem for the given circuit and draw the thevenin equivalent circuit.

STATEMENT:

Thevenin's theorem states that "*Any linear two-terminal circuit can be replaced by an equivalent circuit consisting of a single voltage source V_{Th} in series with a single resistance R_{Th}***"**.

APPARATUS REQUIRED:

S.NO	APPARATUS	RANGE	TYPE	QTY
1.	DC Regulated power supply	(0-30) V	DC	1
2.	Breadboard	840 Tie points	Solderless	1
3.	Ammeter	(0-50) mA	MC	1
4.	Voltmeter	(0-30) V	MC	1
5.	Resistors	220 Ω, 330Ω, 1 KΩ	-	1 each
6.	Multimeter	-	Digital	1
7.	Connecting wires	-	Single strand	As per requirement

PROCEDURE:

To find I_L directly-

1. Connections are made as per the circuit (A).
2. The voltage V_S is set using RPS and the value of I_L is noted.

To find V_{th}-

1. Make the circuit (Figure ii) in bread board
2. Gradually increase the RPS voltage in steps till the rated value and note down the Thevinin's voltage V_{th}.

To find R_{th}-

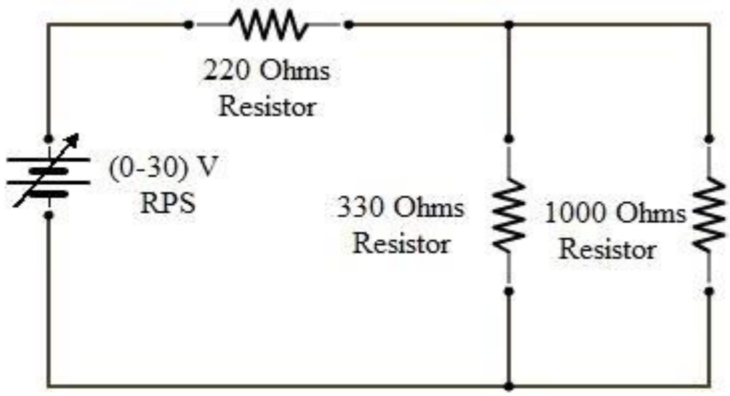
1. Connections are modified as shown in the circuit (iii).
2. Calculate the equivalent resistance using multimeter.

To find I_L-

1) Connections are modified as shown in the circuit (iii).

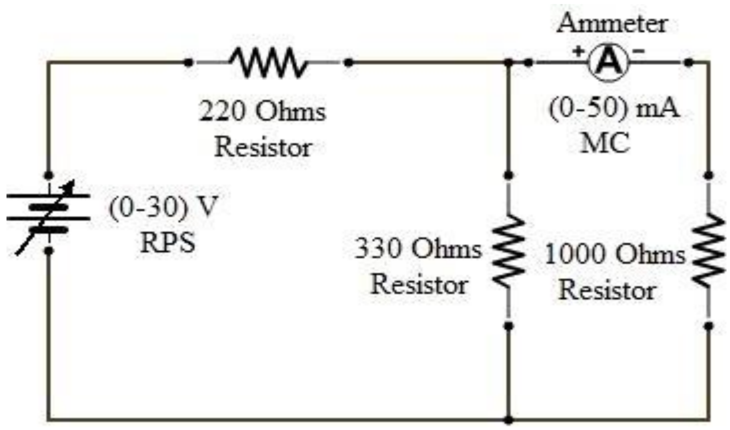
2) Note down the value of I_L for the same value of supply voltage.

ORIGINAL CIRCUIT:



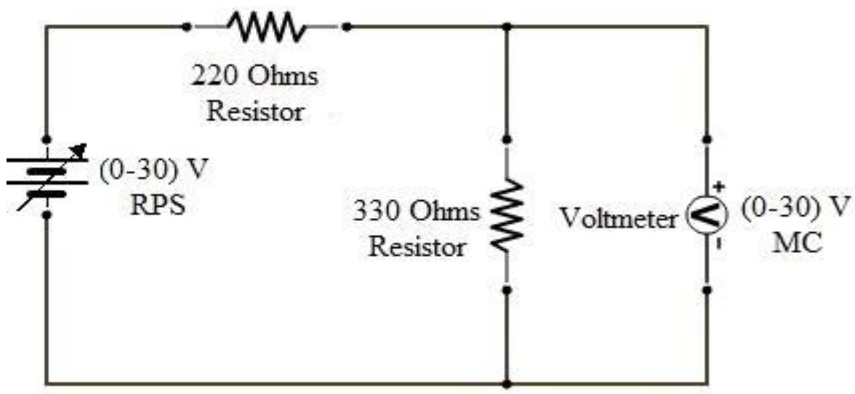
VERIFICATION OF THEOREM:

Practical circuit:



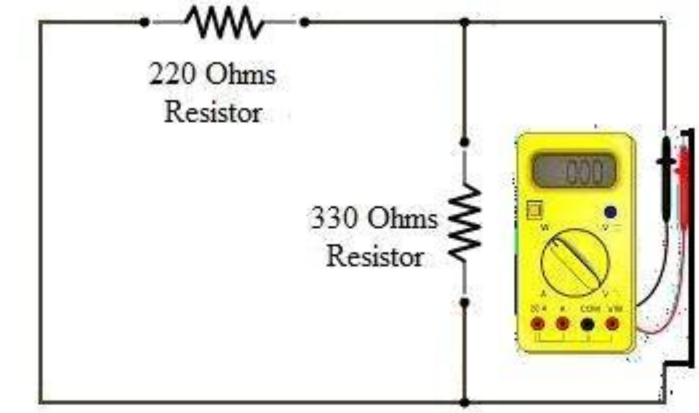
Circuit (i)

To find V_{th}:



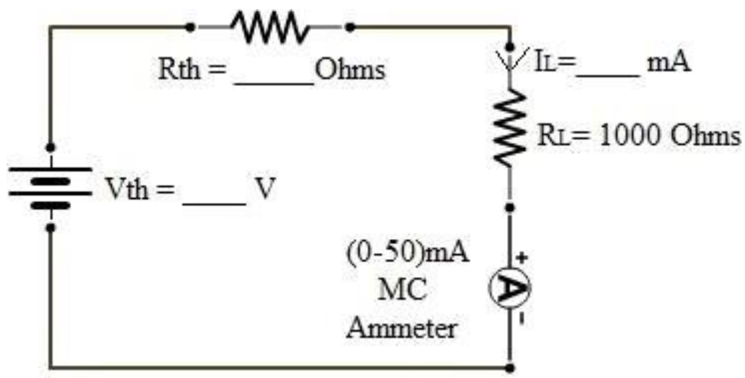
Circuit (ii)

To find R_{th}:



Circuit (iii)

Thevenin's Equivalent circuit:



Circuit (iv)

TABULATION:

Sl. No	V_s (V)	Practical Values				Theoretical Values			
		I_L (original) (mA)	V_{th} (V)	R_{th} (Ω)	I_L (thevenin) (mA)	I_L	V_{th} (V)	R_{th} (Ω)	I_L (thevenin) (mA)

THEORETICAL CALCULATION:

VIVA QUESTIONS:

Q1. Define Thevenin's Equivalent voltage.

Ans:

Q2. State the limitations of Thevenin's Theorem.

Ans:

REC		
DEPT. OF EEE		
	MAX MARKS	**OBT MARKS**
ATTENDANCE	**5**	
OBSERVATION	**5**	
RECORD	**5**	
VIVA	**5**	
TOTAL	**20**	

RESULT:

Thus, Thevenin's theorem is theoretically and practically verified.

EXP. NO: **DATE:**

VERIFICATION OF NORTON'S THEOREM

AIM:

To verify the Norton's theorem theoretically and practically for the given circuit.

STATEMENT:

Norton's theorem states **"***Any linear two-terminal circuit can be replaced by an equivalent circuit consisting of a single current source I_{sc} in parallel with a single resistance R_{th}***"**.

APPARATUS REQUIRED:

S.NO	APPARATUS	RANGE	TYPE	QTY
1.	DC Regulated power supply	(0-30) V	DC	1
2.	Breadboard	840 Tie points	Solderless	1
3.	Ammeter	(0-50) mA	MC	1
4.	Voltmeter	(0-30) V	MC	1
5.	Resistors	220 Ω, 330Ω, 1 KΩ	-	1 each
6.	Multimeter	-	Digital	1
7.	Connecting wires	-	Single strand	As per requirement

PROCEDURE:

To find I_L directly

1. Connections are given as per the circuit diagram.
2. The source voltage Vs is set using RPS and the value of I_L is noted.

To find I_N

1. Connections are given as per the circuit (i)
2. The Load current I_L is noted for various values of supply voltage and tabulated.

To find R_N

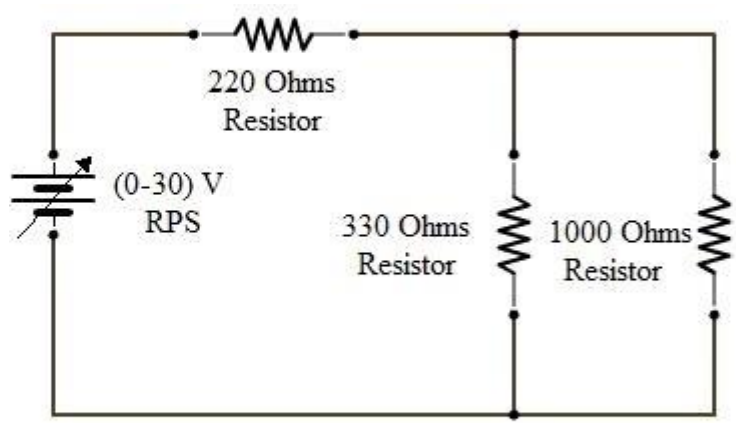
1. Connections are modified as shown in the circuit (ii)
2. The Open circuit voltage (V_{OC}) is noted for various values of the supply voltage and tabulated.

To find I_L

1. Connections are modified as shown in the circuit (iii)
2. The short circuit current (I_{SC}) is noted for various values of the supply voltage and tabulated.

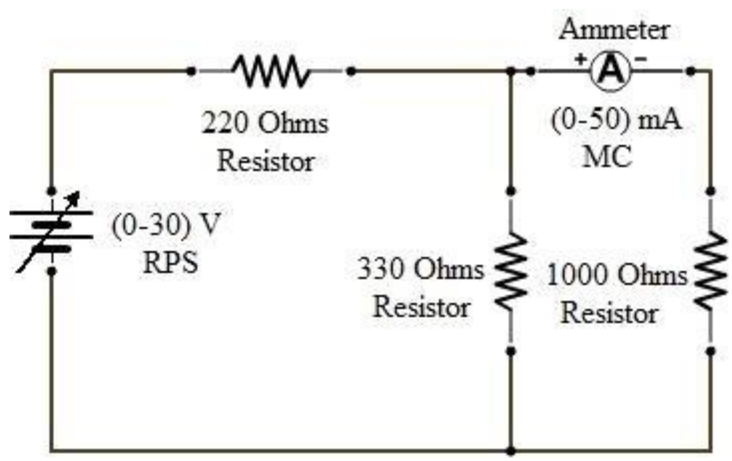
3) Norton's resistance is practically calculated by using the Open circuit voltage and short circuit current.

ORIGINAL CIRCUIT:



VERIFICATION OF NORTON'S THEOREM:

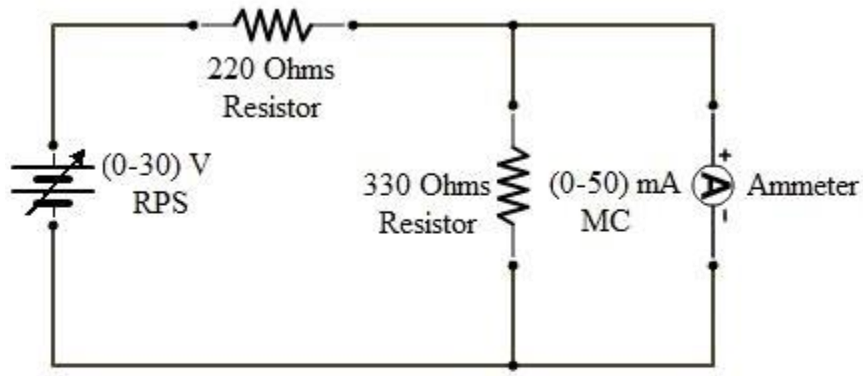
Practical circuit for finding I_L directly



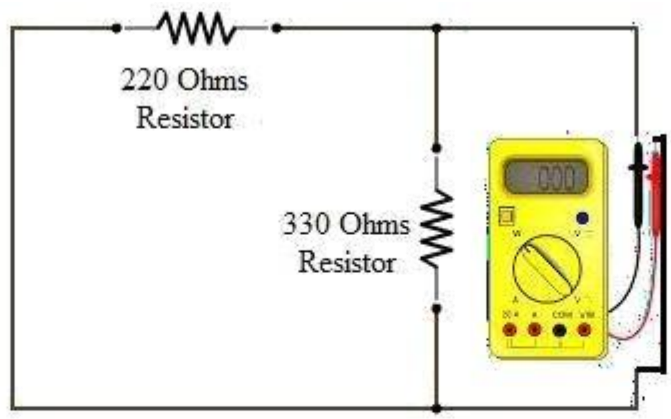
Circuit (i)

To find I_N

To find R_N

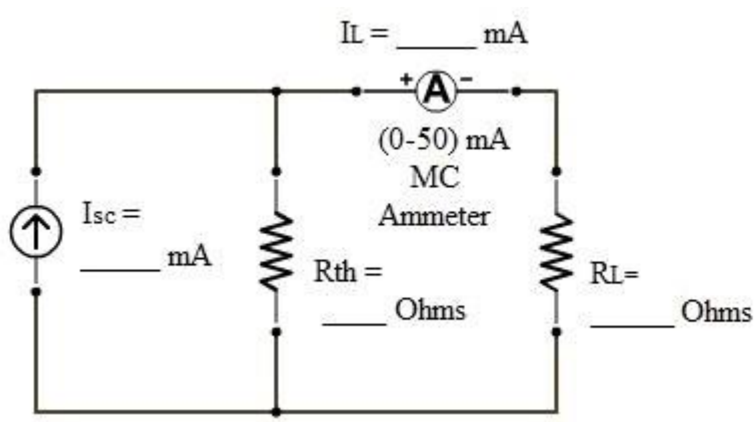


Circuit (ii)



Circuit (iii)

Norton's Equivalent Circuit



Circuit (iv)

TABULATION:

Sl. No.	V_S (V)	I_{sc} (mA)	I_S (mA)	R_N (Ω)	$I_{L(norton)}$ (mA)	$I_{L(orginal)}$ (mA)	Theoretical calculation		
							I_{sc} (mA)	R_N (Ω)	$I_{L(norton)}$ (mA)

THEORETICAL CALCULATION:

VIVA QUESTIONS:

Q1. What is Norton's current?

Q2. How to draw the Norton's equivalent circuit?

REC		
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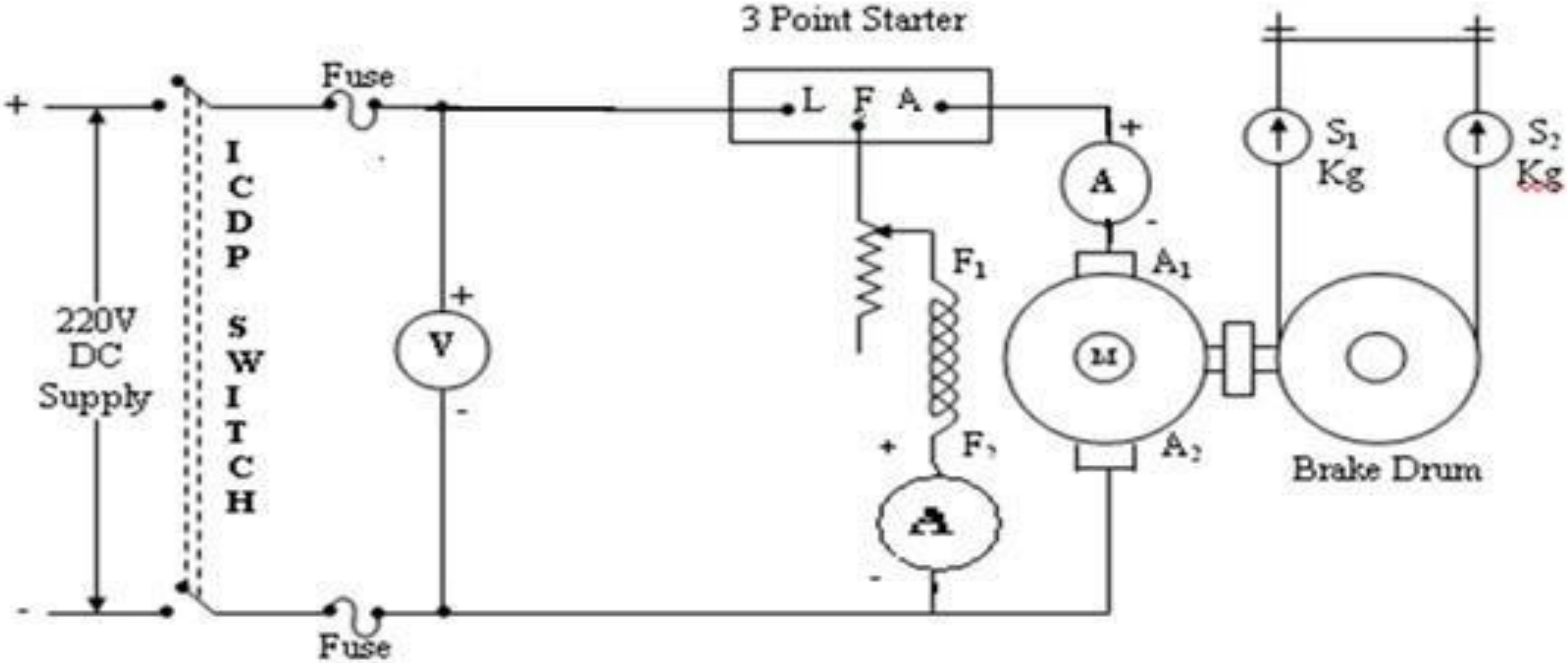
	MAX MARKS	OBT MARKS
ATTENDANCE	5	
OBSERVATION	5	
RECORD	5	
VIVA	5	
TOTAL	20	

RESULT:

Thus, Norton's theorem is theoretically and practically verified for the given circuit.

LOAD TEST ON DC SHUNT MOTOR



FUSE RATING:

125% of rated current

NAME PLATE DETAILS:

Rated Voltage :
Rated Current :
Rated Power :
Rated Speed :

EX.NO: **DATE:**

LOAD TEST ON DC SHUNT MOTOR

AIM:

To conduct load test on DC shunt motor and to draw the performance characteristics.

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	Rheostat			
4	Tachometer			
5	Connecting Wires			

PRECAUTIONS:

- DC shunt motor should be started and stopped under no load condition.
- Field rheostat should be kept in the minimum position during starting and stopping.
- Brake drum should be cooled with water when it is under load.

PROCEDURE:

- Connections are made as per the circuit diagram.
- Supply is given, closing ICDP switch.
- Motor is started with the help of three point starter.
- By adjusting motor field rheostat the motor is brought to rated speed.
- At no load conditions, note down all meter readings and speed of motor.
- By vary load in step by step, all meter readings are noted till upto rated current of motor.
- Before applying load, pour the water in brake drum for cooling purpose.
- Load is gradually reduced to zero, bring motor field rheostat to minimum position.

  Switch off supply and Note down circumference of brake drum and calculateradius.

TABULAR COLUMN: **Circumference of the Brake drum= m.**

S. No.	Voltage V_L (Volts)	Armature Current Ia (Amps)	Field Current I_f (Amps)	Line Current $I_L = Ia + I_f$ (Amps)	Spring Balance Reading		$(S_1 \sim S_2)$ Kg	Speed N (rpm)	Torque T (Nm)	Output Power Pm (Watts)	Input Power P_i (Watts)	Efficiency η %
					S_1(Kg)	S_2(Kg)						

FORMULAE:

$$R = \frac{\text{Circumference}}{2\pi}\ \text{m}$$

Torque $T = (S_1 \sim S_2) \times R \times 9.81$ Nm

Input Power $P_i = V_L I_L$ Watts

$$\text{Output Power } P_m = \frac{2\pi NT}{60}\ \text{Watts}$$

$$\text{Efficiency } \eta\ \% = \frac{\text{Output Power}}{\text{Input Power}} \times 100\%$$

VIVA QUESTIONS

1) Why does a speed of DC shunt motor falls slightly when it is loaded?

2) At the time of starting, why the field rheostat in the DC shunt motor circuit be kept at minimum?

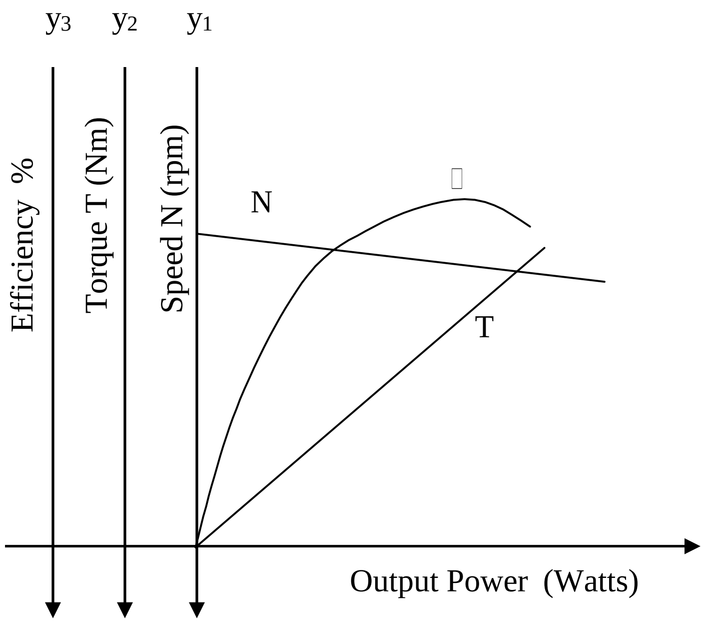
3) What is the percentage fall in speed of a DC shunt motor, when it is loaded from no load to full load?

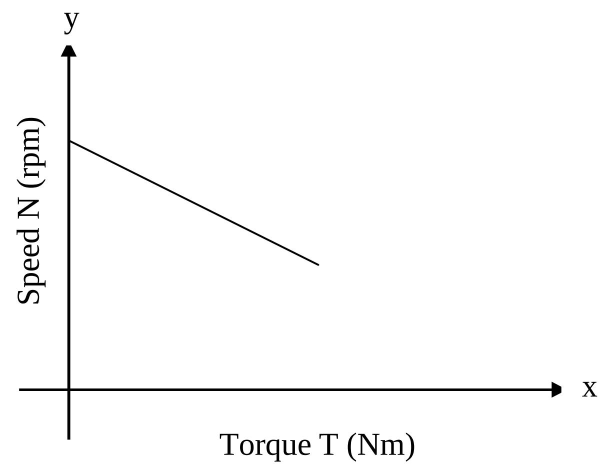
4) What are the aims of performing a load test on DC Shunt motor?

5) What are the applications of DC shunt motor?

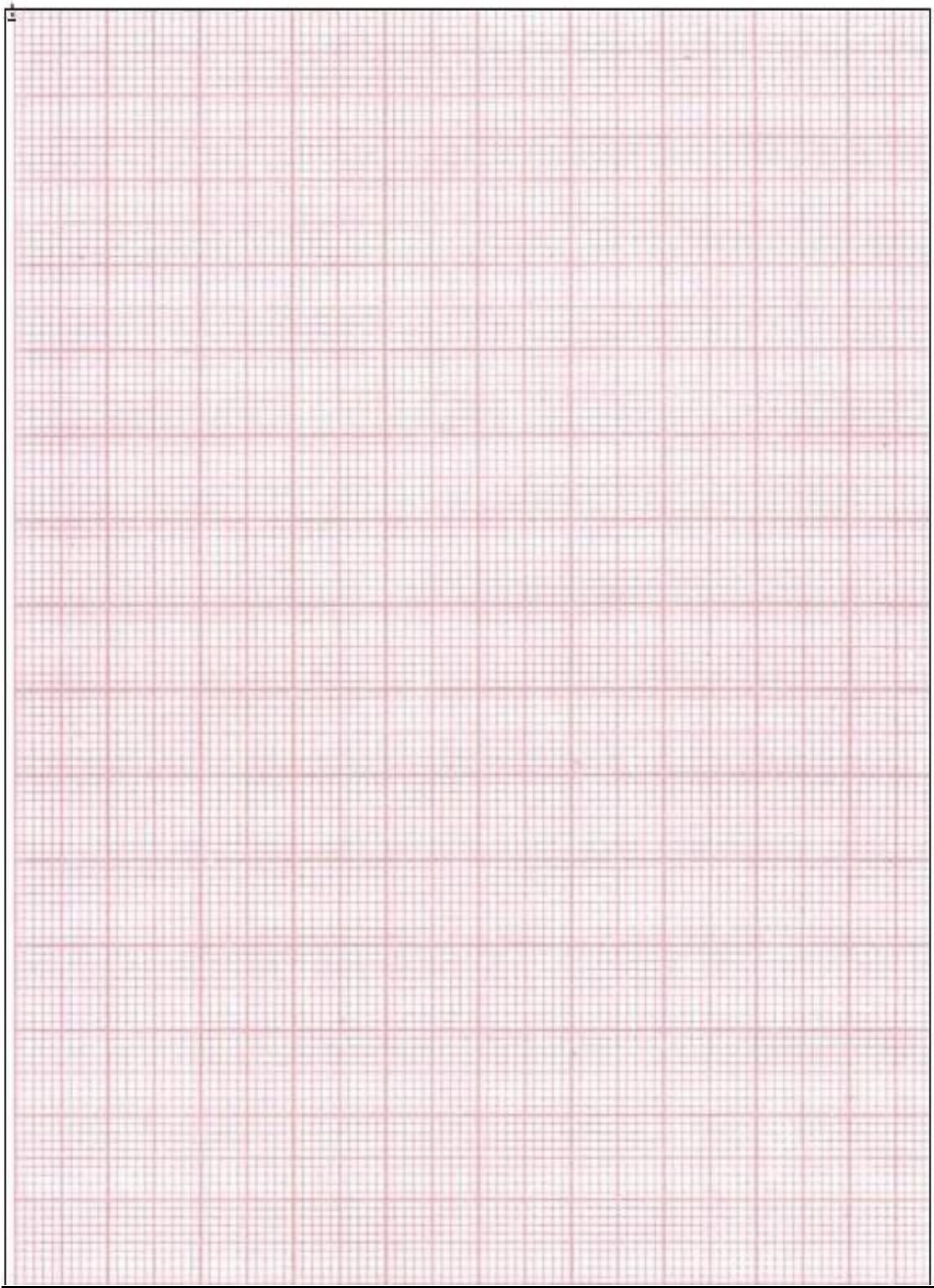
MODEL GRAPHS:

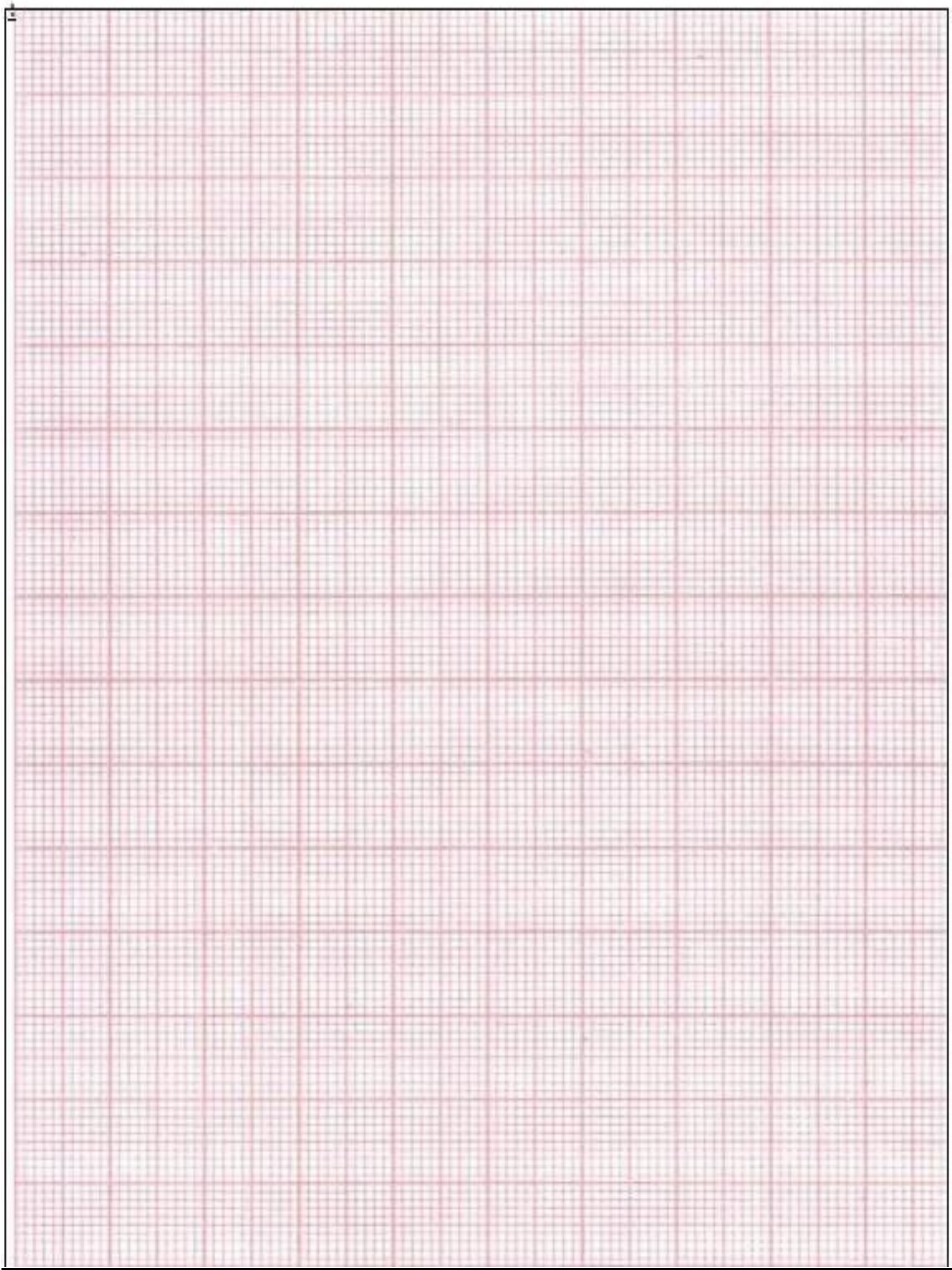
Performance Characteristics **Mechanical Characteristics**





MODEL CALCULATIONS



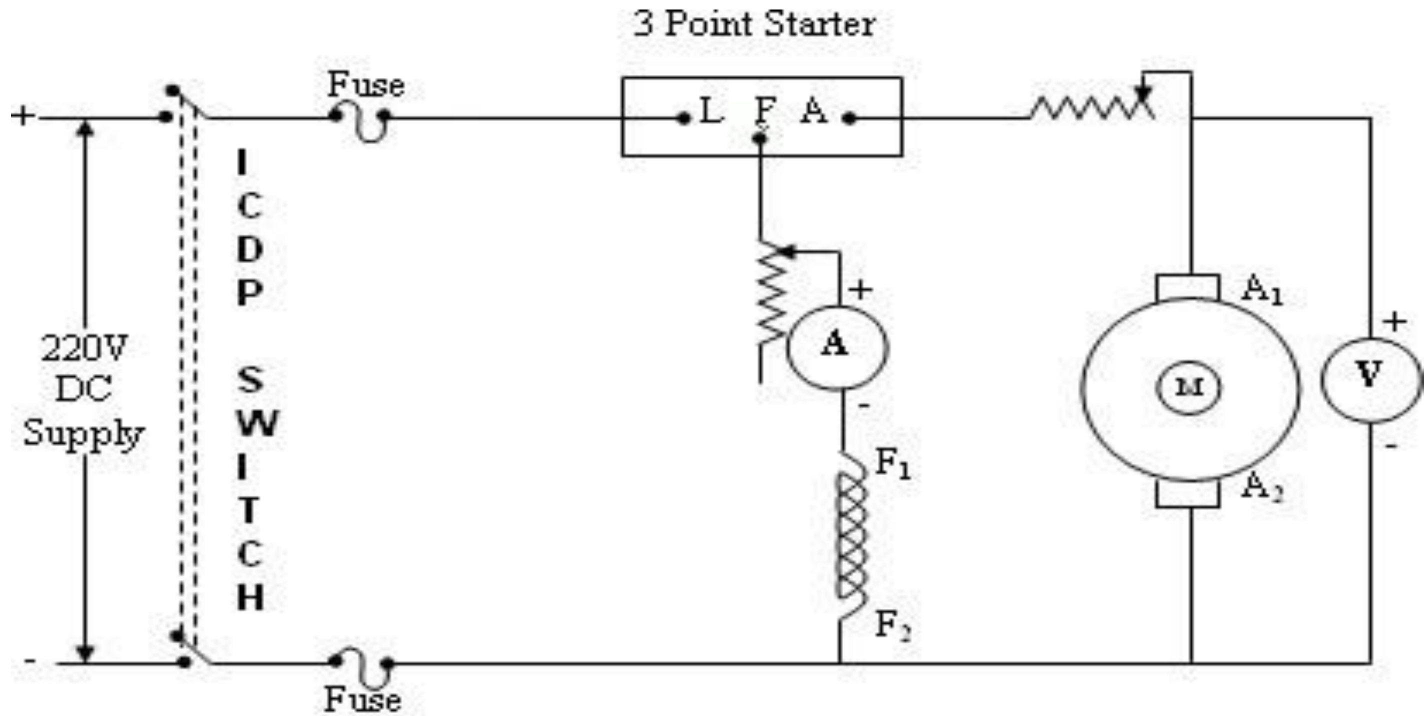


REC		
DEPT. OF EEE		
	MAX MARKS	OBT MARKS
ATTENDANCE	5	
OBSERVATION	5	
RECORD	5	
VIVA	5	
TOTAL	20	

RESULT:

Thus a load characteristic on DC shunt motor is conducted and its performance characteristics are drawn.

SPEED CONTROL OF DC SHUNT MOTOR



FUSE RATING:

40% of rated current

NAME PLATE DETAILS:

Rated Voltage :
Rated Current :
Rated Power :
Rated Speed :

EX. NO. **DATE:**

SPEED CONTROL OF DC SHUNT MOTOR

AIM:

To control speed of DC shunt motor below and above the rated speed by armature control and field control method and to plot

a. Speed Vs armature voltage

b. Speed Vs field current

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	Rheostat			
4	Tachometer			
5	Connecting Wires			

PRECAUTIONS:

- Field Rheostat should be kept in the minimum resistance position at the time of starting and stopping the motor.
- Armature Rheostat should be kept in the maximum resistance position at the time of starting and stopping the motor.

PROCEDURE:

- Connections are made as per the circuit diagram.
- Supply is give, closing ICDP Switch
- Motor is started with the help of three point starter.

(i) Armature Control method:

- The field rheostat is adjusted and field current value is kept constant.
- The applied voltage to the armature is varied by adjusting the armature rheostat and reading of voltmeter and speed are tabulated.
- The above procedure is repeated for various values of field control.

(ii) Field Control method:

- The armature rheostat is adjusted and armature voltage is kept constant.
- The field current is varied by adjusting the field rheostat and reading of ammeter and speed are tabulated.

- The above procedure is repeated for various values of armature voltage.
- Bring back the field and armature rheostat to minimum and maximum position
- Switch off supply.

TABULAR COLUMN:

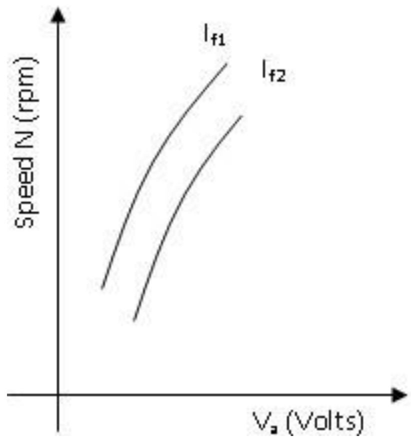
(i) Armature Voltage Control:

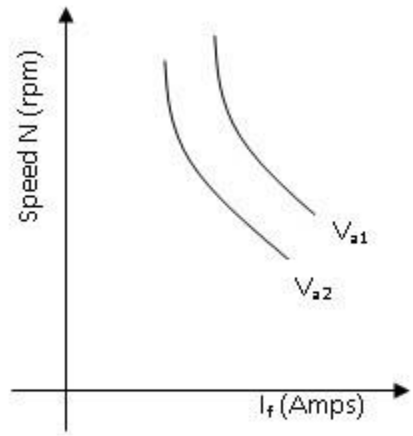
S.No.	**I_{f1} =**		**I_{f2} =**	
	Armature Voltage V_a (Volts)	**Speed N (rpm)**	**Armature Voltage V_a (Volts)**	**Speed N (rpm)**

(ii) Field Control:

S.No.	**V_{a1} =**		**V_{a2} =**	
	Field Current I_f (A)	**Speed N (rpm)**	**Field Current I_f (A)**	**Speed N (rpm)**

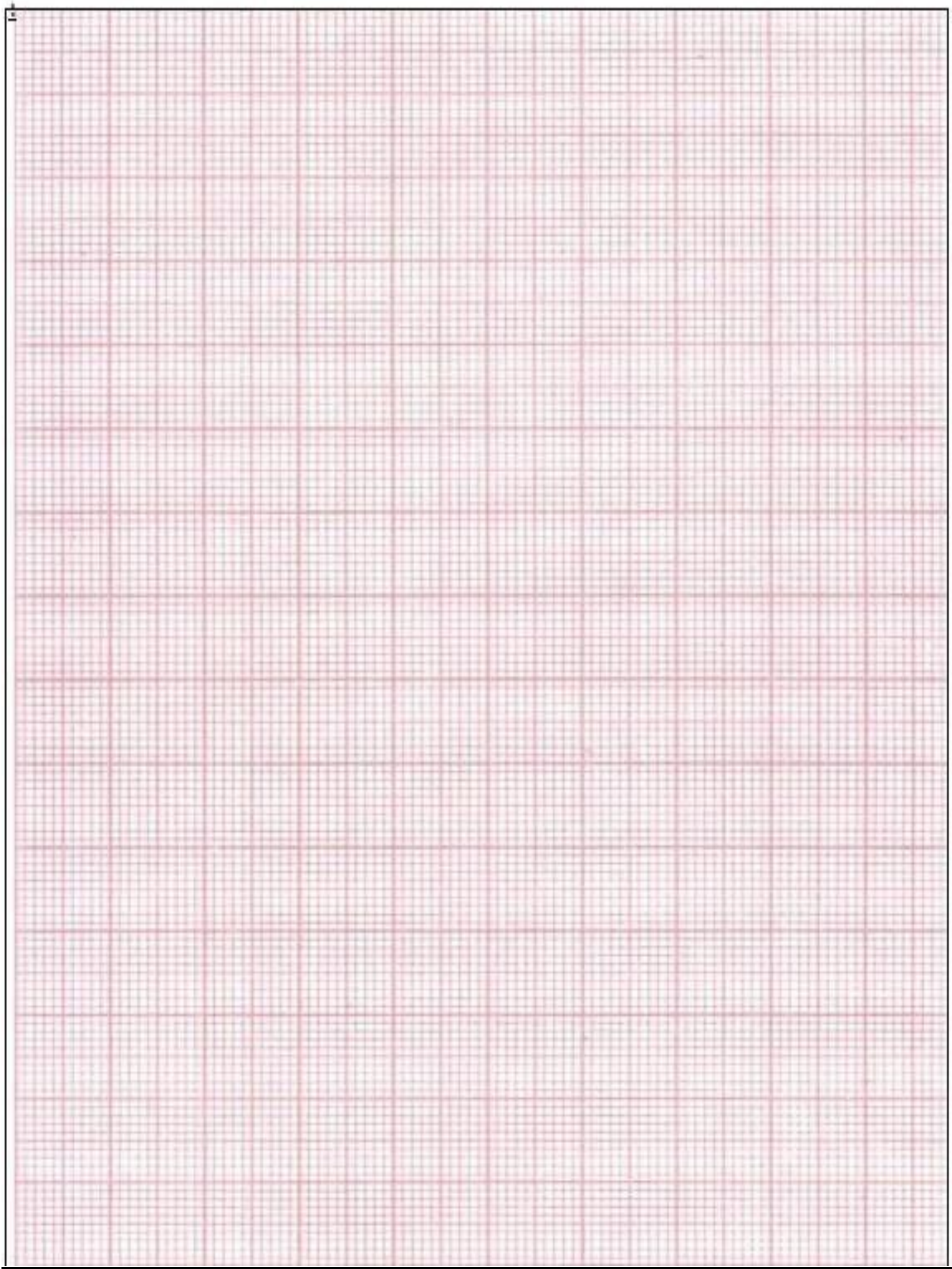
MODEL GRAPHS:

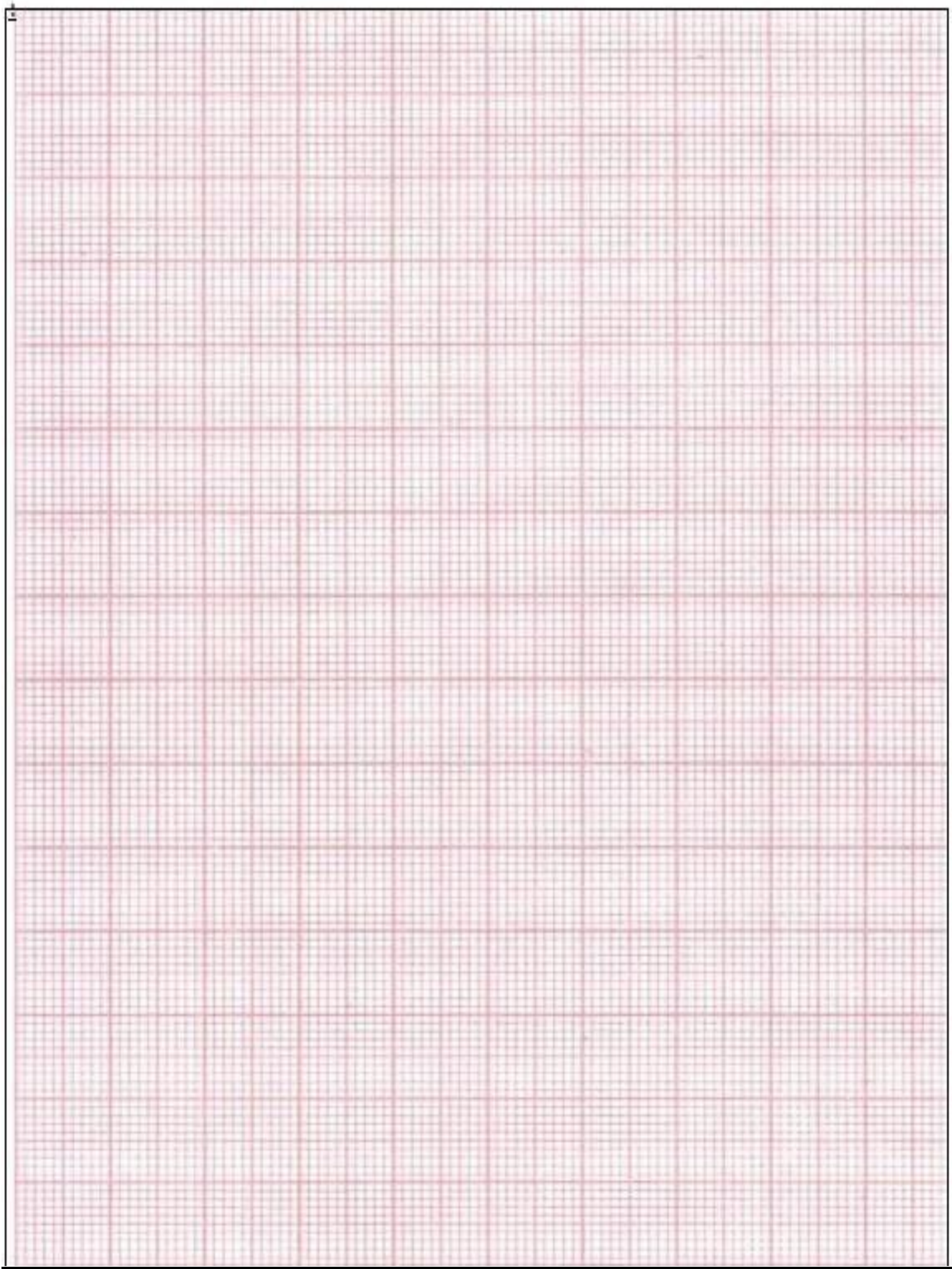




VIVA QUESTIONS:

1) What range of speed can you get with the field control method of speed control of DC shunt motor?
2) What would you do to reverse the direction of rotation of a DC shunt motor?
3) What are the limitations of armature control method for speed control of DC shunt motor?
4) What are the limitations of field control method for speed control of DC shunt motor?
5) Why is the speed of a DC shunt motor practically constant?



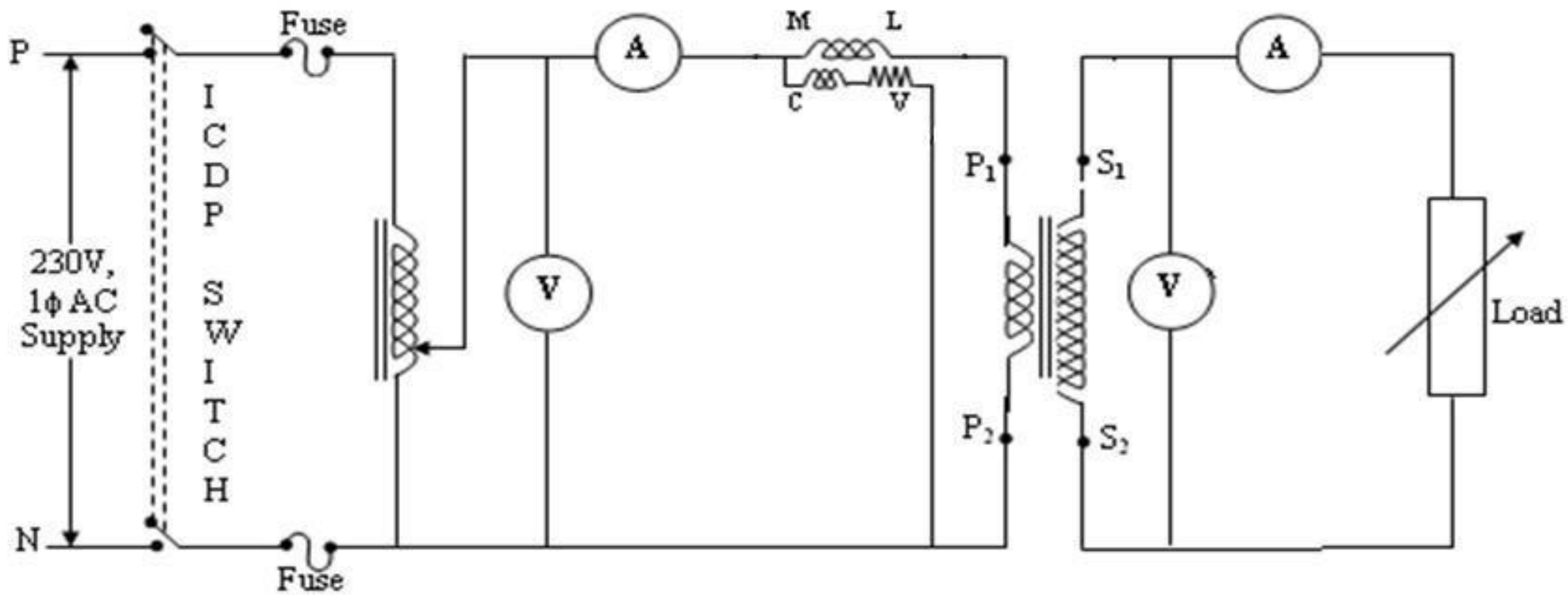


REC		
DEPT. OF EEE		
	MAX MARKS	OBT MARKS
ATTENDANCE	5	
OBSERVATION	5	
RECORD	5	
VIVA	5	
TOTAL	20	

RESULT:

Thus the speed control of DC Shunt Motor is obtained using Armature and Field control methods

LOAD TEST ON A SINGLE PHASE TRANSFORMER



FUSE RATING:

125% of rated current

NAME PLATE DETAILS:

	Primary	**Secondary**
Rated Voltage :		
Rated Current :		
Rated Power :		

EX.NO. **DATE :**

LOAD TEST ON A SINGLE PHASE TRANSFORMER

AIM:

To determine the % efficiency and % regulation of the given single phase transformer by conducting load test on it.

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	Wattmeter			
4	Testing Transformer			
5	Auto Transformer			
6	Resistive Load			
7	Connecting Wires			

PRECAUTIONS:

- Auto Transformer should be in minimum position.
- The Load should be kept off at the time of starting and stopping..

PROCEDURE:

- Connections are made as per the circuit diagram.
- Supply is given, closing ICDP Switch.
- Rated voltage is applied to the primary side by adjusting the single phase variac.
- At no load conditions all meters readings are noted.
- The load is increased till the rated current of secondary side.
- For each load, all meter readings are noted.
- For each load, primary voltage is reduced. By adjusting single phase variac maintain the primary voltage is constant.
- Again the load is gradually reduced to zero.
- Auto transformer brings to minimum position.
- Switch off supply

TABULAR COLUMN

S.No.	Primary Current I_1 (A)	Primary Voltage V_1(V)	Secondary Current I_2 (A)	Secondary Voltage V_2(V)	Wattmeter Reading (W)		Input Power P_i (W)	Output Power P_o (W)	Efficiency η %	% Regulation
					Observed	Actual				

FORMULAE:

Output Power $P_O = V_2 I_2$ (W)

Input Power P_i= wattmeter reading in W

$$\text{Efficiency } \eta\ \% = \frac{\text{Output Power}}{\text{Input Power}} \times 100\%$$

$$\text{Regulation R } \% = \frac{V_{NL} - V_2}{V_{NL}} \times 100\%$$

V_1, I_1 -> Primary Voltage (V), Primary Current (A)

V_2, I_2 -> Secondary Voltage (V), Secondary Current (A)

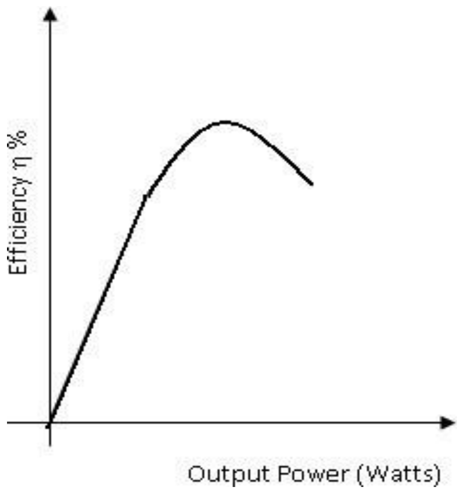
V_{NL}, V_L-> No load voltage, Load Voltage (V)

VIVA QUESTIONS:

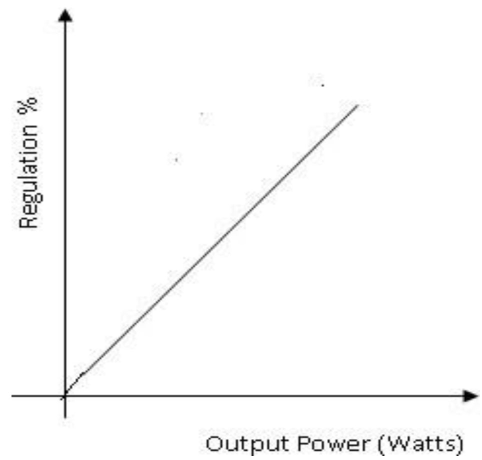
1) What are the applications of transformers?
2) What is the principle of transformer?
3) When core type and shell type transformers are used?
4) When maximum efficiency does occur in a single phase transformer?
5) What is the significance of voltage regulation?

MODEL GRAPHS:

% Efficiency Vs Output Power



% Regulation Vs Output Power



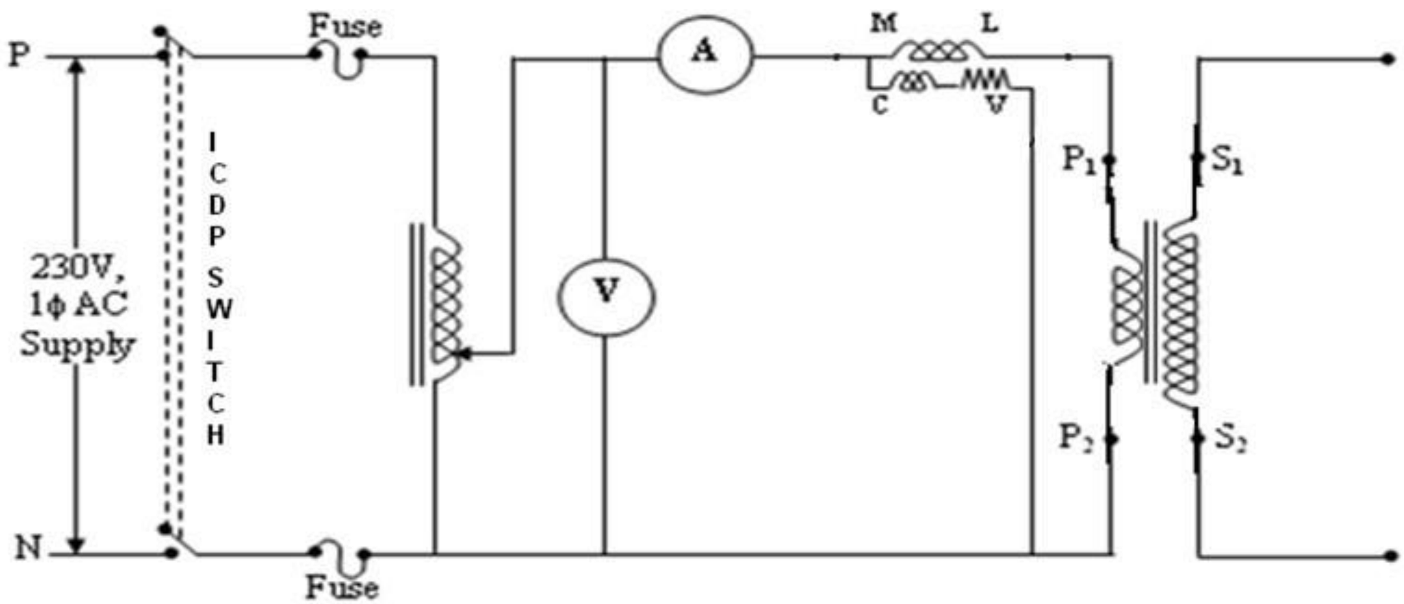
MODEL CALCULATIONS:

REC		
DEPT. OF EEE		
	MAX MARKS	OBT MARKS
ATTENDANCE	5	
OBSERVATION	5	
RECORD	5	
VIVA	5	
TOTAL	20	

RESULT:

The % efficiency and % regulation of the given single phase transformer were determined by conducting load test on it.

OPEN CIRCUIT TEST:



FUSE RATING:

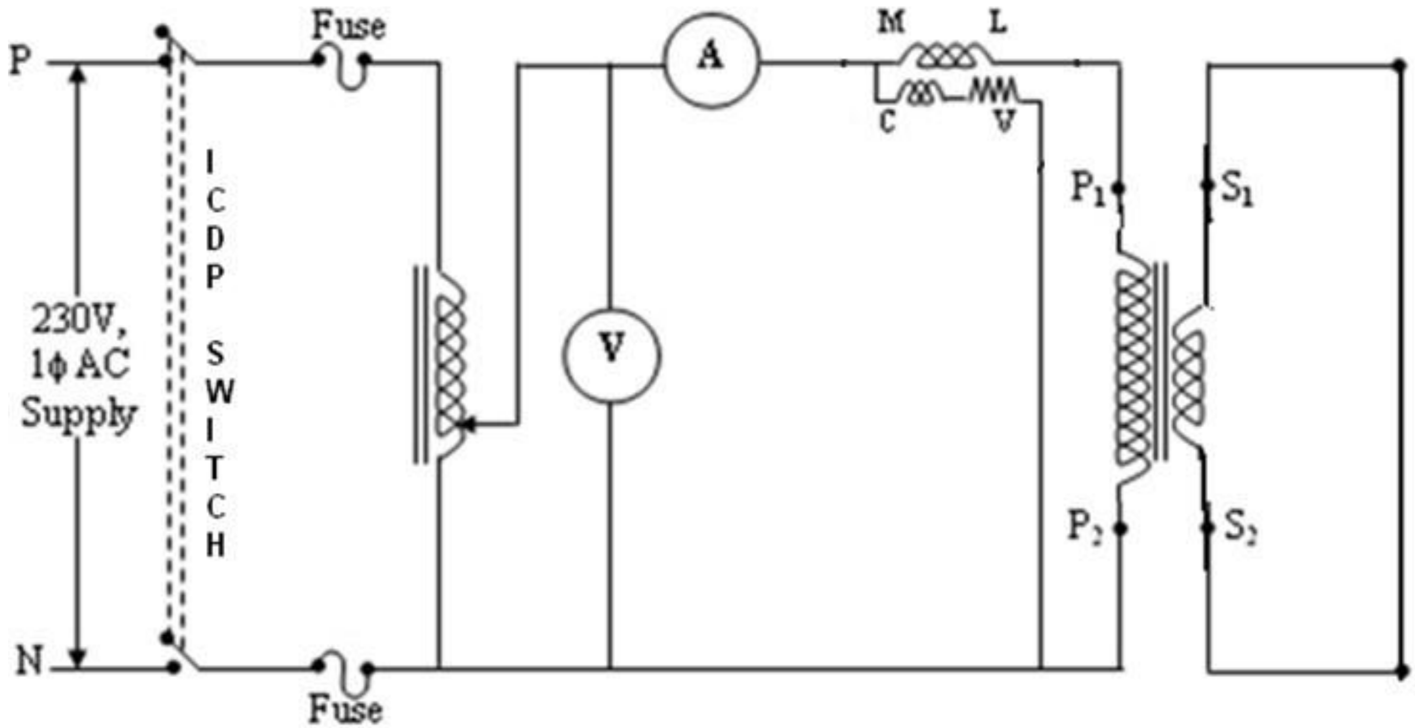
40% of rated current

.

NAME PLATE DETAILS:

	Primary	**Secondary**
Rated Voltage :		
Rated Current :		
Rated Power :		

SHORT CIRCUIT TEST:



FUSE RATING:

125% of rated current

NAME PLATE DETAILS:

	Primary	Secondary
Rated Voltage :		
Rated Current :		
Rated Power :		

EX.NO. **DATE :**

OPEN CIRCUIT & SHORT CIRCUIT TEST ON A SINGLE PHASE TRANSFORMER

AIM:

To predetermine the efficiency and regulation of a transformer by conducting open circuit test and short circuit test and to draw equivalent circuit.

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	Wattmeter			
4	Testing Transformer			
5	Auto Transformer			
6	Connecting Wires			

PRECAUTIONS:

- ❖ Auto Transformer should be kept at zero voltage position before starting and stopping on the AC supply

PROCEDURE:

OPEN CIRCUIT TEST:

- ❖ Connections are made as per the circuit diagram.
- ❖ Supply is given, closing ICDP switch.
- ❖ Auto transformer is adjusted get the rated primary voltage.
- ❖ Voltmeter, Ammeter and Wattmeter readings on primary side are noted.
- ❖ Auto transformer is again brought to minimum position of ICDP switch is opened.

SHORT CIRCUIT TEST:

- Connections are made as per the circuit diagram.
- Supply is given, closing ICDP switch.
- Auto transformer is adjusted get the rated primary current.
- Voltmeter, Ammeter and Wattmeter readings on primary side are noted.
- Auto transformer is again brought to minimum position of ICDP switch is opened.

TABULAR COLUMN:

OPEN CIRCUIT TEST: **M.F =**

S.No	Open circuit voltage V_o (V)	Open circuit current I_o (A)	Wattmeter Reading W_o (W)	
			Observed	Actual

SHORT CIRCUIT TEST: **M.F =**

S.No	Short circuit voltage V_{sc} (V)	Short circuit current I_{sc} (A)	Wattmeter Reading W_{sc} (W)	
			Observed	Actual

To find the efficiency and regulation

S.No	Fraction of load, X	Output power (W) $P_O=(X)xKVAx1000x \cos□_o$	Losses $W_o+X^2W_{sc}$ (W)	Input power (W) P_i = Output power+ Losses	% □

To find the efficiency and regulation

S.No	Power factor	% Regulation	
		Lag	Lead

FORMULAE:

$$\cos\Box_o = \frac{W_o}{V_o I_o} \qquad \Box_o = \cos^{-1}\frac{W_o}{V_o I_o}$$

$I_\Box = I_o\cos\Box_o$ (Amps) $\qquad I_\Box = I_o\sin\Box_o$ (Amps)

$$R_o = \frac{V_0}{I_\Box}\ \Box \qquad X_o = \frac{V_0}{I_\Box}\ \Box \qquad R_{o2} = \frac{W_{sc}}{I_{sc}^2}\ \Box$$

$$Z_{o2} = \frac{V_{sc}}{I_{sc}}\ \Box \qquad X_{o2} = (Z_{o2}^2 - R_{o2}^2)^{1/2}$$

$$R_{o1} = \frac{R_{02}}{K^2}\ \Box \qquad X_{o1} = \frac{X_{02}}{K^2}\ \Box \qquad K = \frac{V_2}{V_1}$$

To predetermine the efficiency, let X be the fraction of load

X=1 for full load

X=1/2 for half load

Assume the power factor

Output Power = (X) x KVA rating x 1000 x $\cos\Box_o$ (W)

Losses = $W_o + X^2 W_{sc}$ (W)

Input Power = Output power + Losses

$$\text{Efficiency } \Box\% = \frac{\text{Output Power}}{\text{Input Power}}$$

Percentage Regulation:

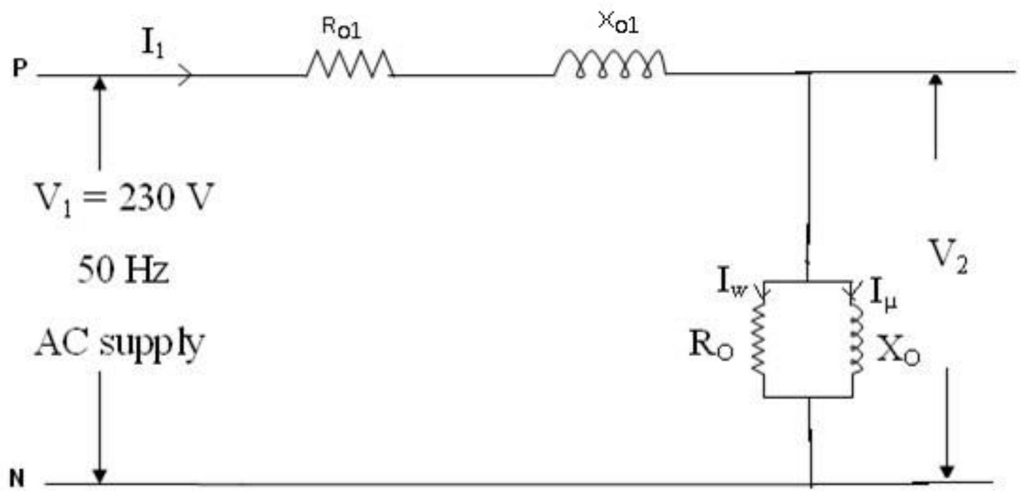
$$\%\text{ voltage regulation} = \frac{I_1 (R_{o1}\cos\Box \ \Box\ X_{o1}\sin\Box)}{V_1} \times 100$$

\+ for lagging p.f

\- for leading p.f

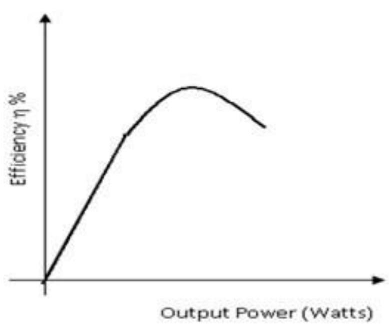
V_1 => Primary Voltage.

EQUIVALENT CIRCUIT:

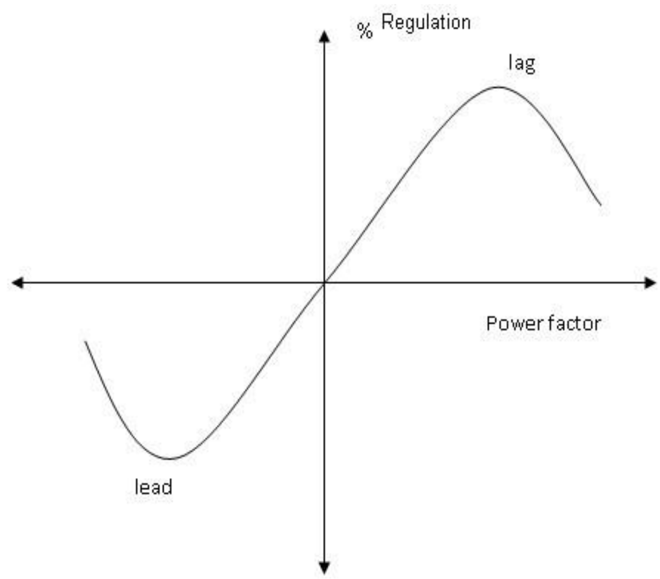


MODEL GRAPHS:

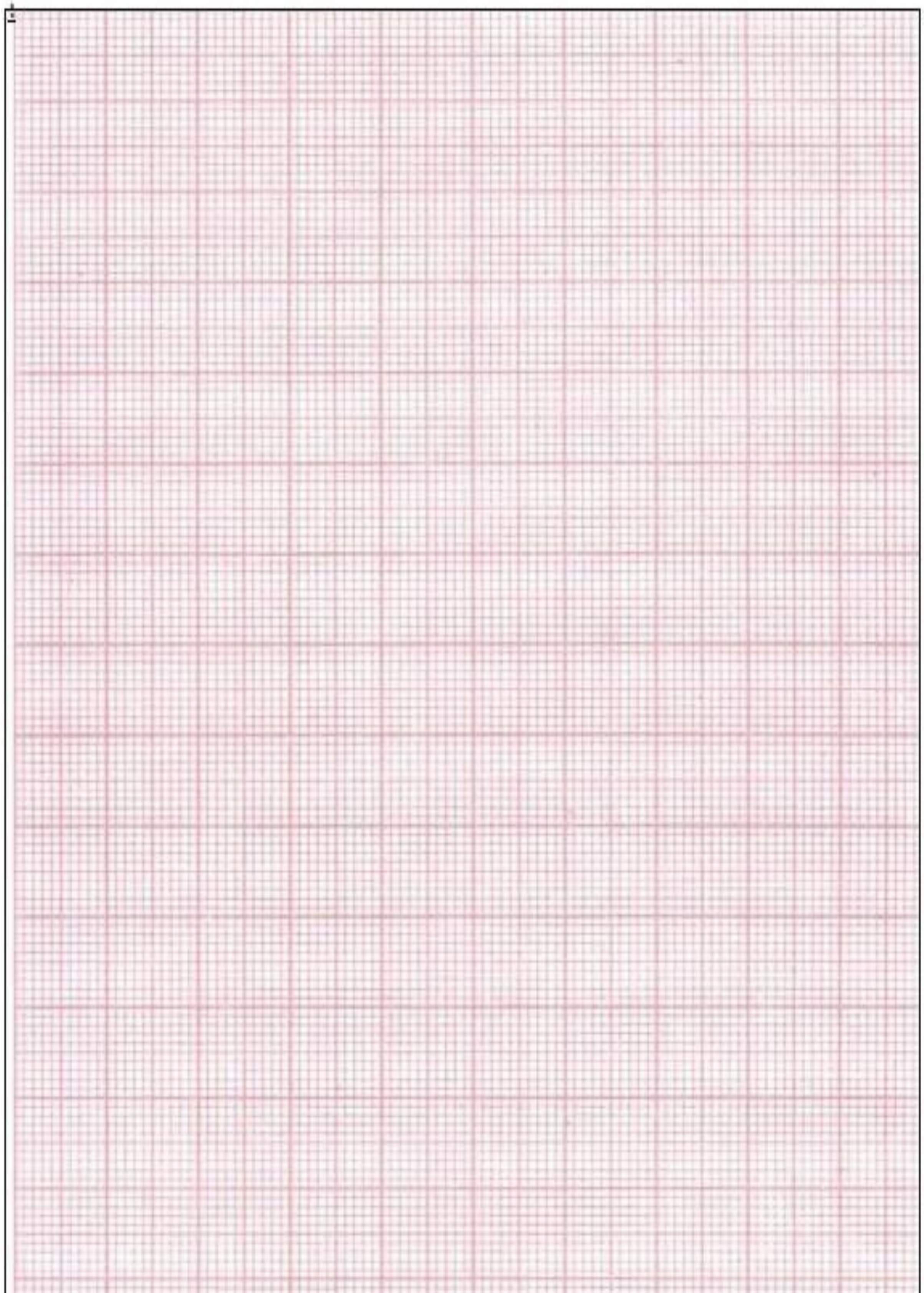
% Efficiency Vs Output Power



% Regulation Vs Power factor



MODEL CALCULATION:



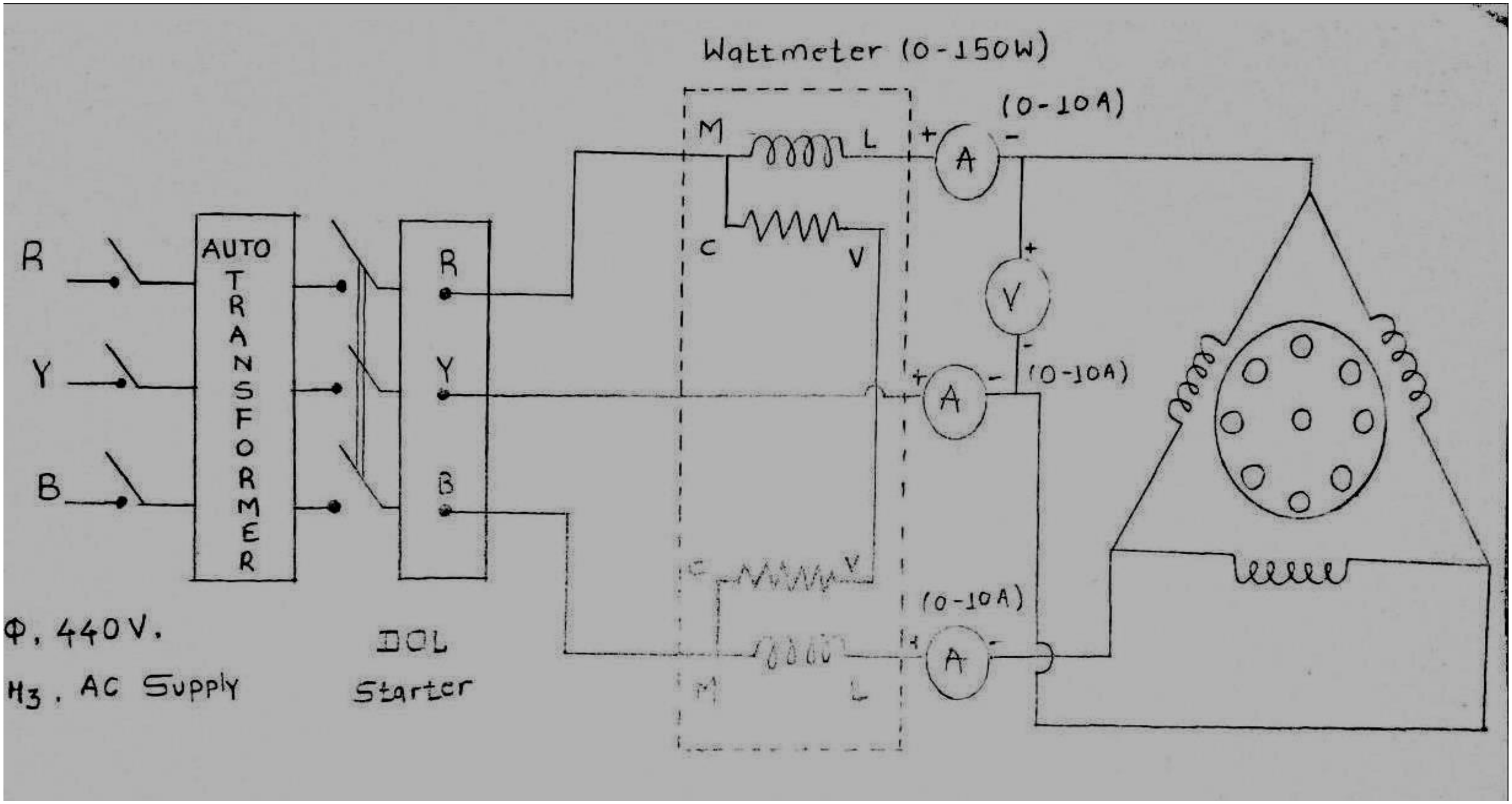
VIVA Questions:

1) What is the purpose of OC test?
2) What is the purpose of SC test?
3) Is the flux in the transformer is constant? How?
4) What are constant and variable losses in Transformers?
5) What are Iron losses?

REC		
DEPT. OF EEE		
	MAX MARKS	OBT MARKS
ATTENDANCE	5	
OBSERVATION	5	
RECORD	5	
VIVA	5	
TOTAL	20	

RESULT:

Thus the efficiency and regulation of a transformer is predetermined by conducting open circuit test and short circuit test and the equivalent circuit is drawn.



FUSE RATING:

125% of rated current

NAME PLATE DETAILS:

Rated Voltage :
Rated Current :
Rated Power :
Rated Speed :

EX.NO. **DATE:**

SPEED CONTOROL OF THREE PHASE SQUIRREL CAGE INDUCTION MOTOR

AIM:

To perform speed control of three phase induction motor using autotransformer by changing supply voltage.

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter			
2	Voltmeter			
3	Wattmeter			
5	Auto Transformer			
6	Threephase induction motor			
7	Wattmeter			
8	Connecting wires			

Theory:

Three phase IM works on faradays law of electromagnetic induction. The speed of three phase IM can changed by using three phase autotransformer. The speed of three phase IM can be changed by the the supply voltage. The speed can be changed by using following factors :

1 By controlling stator parameters

2 By controlling rotor parameters

The expression for actual speed of IM can be given by

$$N=Ns(1-S)$$

This shows that the actual speed depends on two factors mainly Synchronous speed and Slip.By changing these factors we can change the speed of IM.

Another way to change the speed of three phase IM from torque equation of motor

$$T = \frac{k_1 s E_2^2 R_2}{\sqrt{(R_2^2 + (s X_2)^2)}} = \frac{3}{2\pi N_s} \frac{s E_2^2 R_2}{\sqrt{(R_2^2 + (s X_2)^2)}}$$

but R2 is constant and K is also constant .Hence This directly proportional to SV^2

In these type of speed control of the stator supply voltage V1 is reduced from rated voltage

Hence from the above expression we can control the speed of three phase IM by varying the supply voltage.

Procedure:

1. Make the connection as per circuit diagram
2. Vary the auto transformer and keep at rated voltage.
3. Note the voltage and speed of the motor.
4. Reduce the voltage by using auto transformer and note down the speed.

Tabulation

S. No	Voltage (V)	Speed R.P.M

REC		
DEPT. OF EEE		
	MAX MARKS	**OBT MARKS**
ATTENDANCE	**5**	
OBSERVATION	**5**	
RECORD	**5**	
VIVA	**5**	
TOTAL	**20**	

RESULT:

Hence from the above experiment we have successfully observed the variation of speed of three phase IM with varying the three phase AC input supply by using three phase autotransformer.

EX.NO. **DATE:**

STUDY OF CHOPPER FED DC DRIVE

AIM:

To implement microcontroller based PMDC motor using four quadrant IGBT chopper.

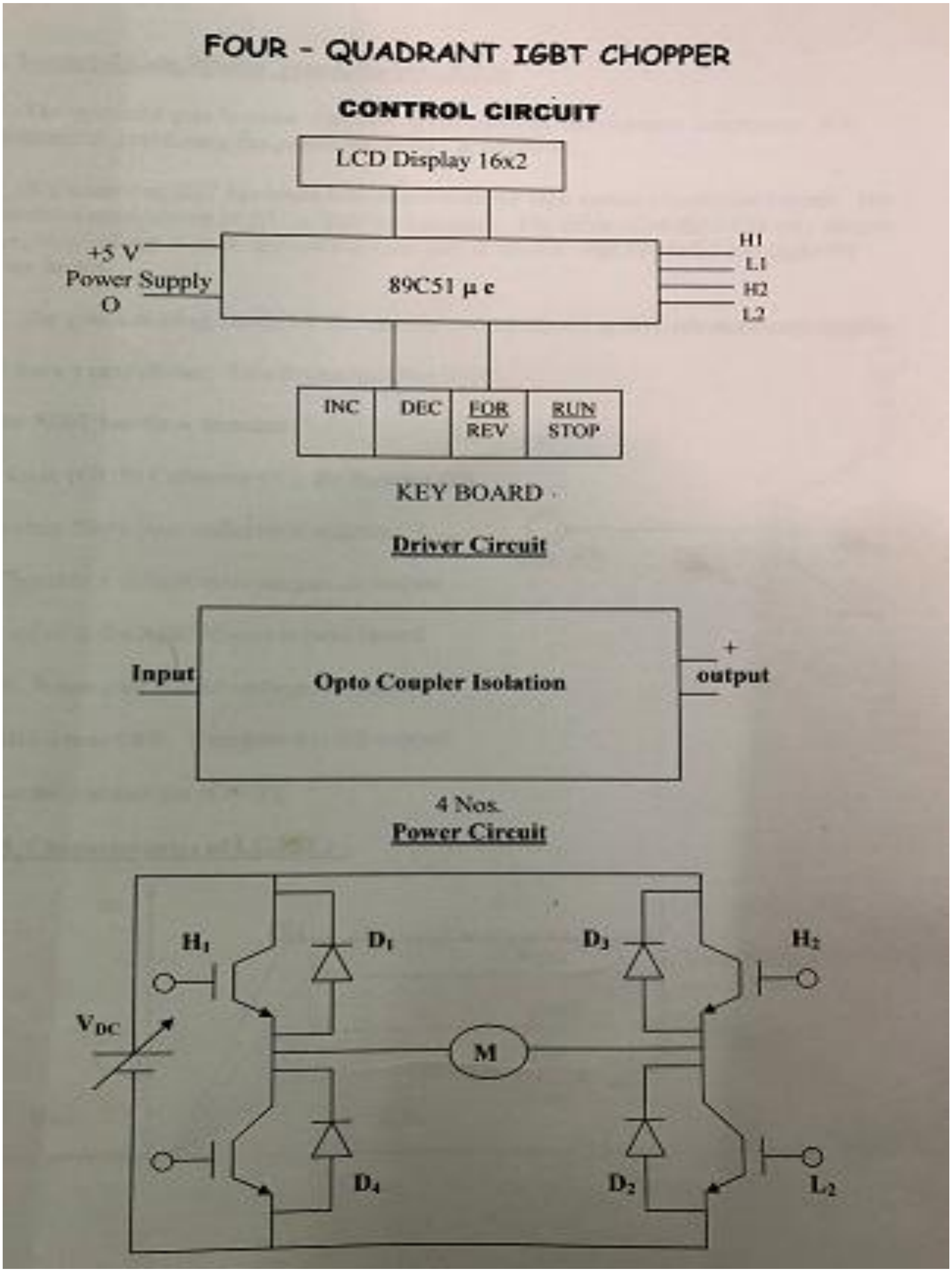
APPARATUS REQUIRED:

Sl.No.	Name	Range	Type	Quantity
1	Chopper Control Circuit			
2	Chopper Power Circuit			
3	89C51 µC Unit			
4	IGBT	19A/600V		
5	LCD Display			
6	CRO			
7	Multimeter			

PROCEDURE:

- Switch ON the mains supply to the controller unit. The LCD display shows PWM Chopper with Forward / Reverse direction and PW – Duty cycle 00 and in OFF Position.
- Now use INC and DEC key to increase or decrease the duty cycle from 00% to 100%. After setting the duty cycle and Press RUN/STOP Key. Now the driver O/Ps Pulses are available at O/Ps H_1,L_1, H_2 and L_2. Soft start feature is provided.
- The duty cycle starts from 1 degree and slowly comes to the set duty cycle. When we press RUN/STOP Key again, the driver O/Ps are comes to OFF with soft stop. Make sure that the driver outputs are proper before connecting to the power circuit.
- Now make the connections as given in the circuit diagram. Connect DC supply from 30V/2A Regulated Power Supply Unit.
- Connect a resistive load – 50 Ohms or 100 Ohms 2 Amps Rheostat or 24 Volts PMDC motor at load terminals.
- Connect driver output signals to the Gate and Emitter of corresponding IGBT's Switch ON the DC supply. Switch ON the driver outputs and observe the output voltage across the load.
- Check the outputs for both forward and reverse direction and also observe the speed variation as we vary the duty cycle. Observe the change of direction of rotation when we change the direction.

CIRCUIT DIAGRAM :



TABULATION:

S.No	Mode of Operation	Condition of PMDC motor
1	Forward Motoring	
2	Forward Braking	
3	Reverse Motoring	
4	Reverse Braking	

VIVA QUESTIONS:

1. Define duty cycle

2. What are the different control strategies of chopper?

3. What are the limitations of variable frequency control of chopper?

4. List few applications of dc chopper.

5. What is meant by PWM control in dc chopper?

REC		
DEPT. OF EEE		
	MAX MARKS	**OBT MARKS**
ATTENDANCE	**5**	
OBSERVATION	**5**	
RECORD	**5**	
VIVA	**5**	
TOTAL	**20**	

RESULT:

Thus the microcontroller based PMDC motor using Four Quadrant IGBT chopper is successfully implemented. Control circuit provides controlling of switching frequency, soft starting & soft stopping.