ELECTRICAL ENGINEERING LAB

II B.Tech-I SEMESTER

STUDENT OBSERVATION RECORD

Name: ______________________________

H.T.No: ______________________________

Year/Semester: ______________________________

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

VEMU INSTITUTE OF TECHNOLOGY::P.KOTHAKOTA

NEAR PAKALA, CHITTOOR-517112

(Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu)

VEMU INSTITUTE OF TECHNOLOGY

DEPT.OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE INSTITUTE

- To be a premier institute for professional education producing dynamic and vibrant force of technocrats with competent skills, innovative ideas and leadership qualities to serve the society with ethical and benevolent approach.

MISSION OF THE INSTITUTE

- To create a learning environment with state-of-the art infrastructure, well equipped laboratories, research facilities and qualified senior faculty to impart high quality technical education.
- To facilitate the learners to foster innovative ideas, inculcate competent research and consultancy skills through Industry-Institute Interaction.
- To develop hard work, honesty, leadership qualities and sense of direction in rural youth by providing value based education.

VISION OF THE DEPARTMENT

- To produce professionally deft and intellectually adept Electrical and Electronics Engineers and equip them with the latest technological skills, research & consultancy competencies along with social responsibility, ethics, Lifelong Learning and leadership qualities.

MISSION OF THE DEPARTMENT

- To produce competent Electrical and Electronics Engineers with strong core knowledge, design experience & exposure to research by providing quality teaching and learning environment.
- To train the students in emerging technologies through state - of - the art laboratories and thus bridge the gap between Industry and academia.
- To inculcate learners with interpersonal skills, team work, social values, leadership qualities and professional ethics for a holistic engineering professional practice through value based education.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

Programme Educational Objectives (PEOs) of B.Tech (Electrical and Electronics Engineering) **program are:**

Within few years of graduation, the graduates will

PEO 1: Provide sound foundation in mathematics, science and engineering fundamentals to analyze, formulate and solve complex engineering problems.

PEO 2: Have multi-disciplinary Knowledge and innovative skills to design and develop Electrical & Electronics products and allied systems.

PEO 3: Acquire the latest technological skills and motivation to pursue higher studies leading to research.

PEO 4: Possess good communication skills, team spirit, ethics, modern tools usage and the life-long learning needed for a successful professional career.

PROGRAM OUTCOMES (POs)

PO-1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO-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.
PO-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.
PO-4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-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.
PO-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.
PO-7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	**Individual and team work:** Function effectively as an individual, and as a member or leader

	in diverse teams, and in multidisciplinary settings.
PO-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.
PO-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.
PO-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)

On completion of the B.Tech. (Electrical and Electronics Engineering) degree, the graduates will be able to

PSO-1: Higher Education: Apply the fundamental knowledge of Mathematics, Science, Electrical and Electronics Engineering to pursue higher education in the areas of Electrical Circuits, Electrical Machines, Electrical Drives, Power Electronics, Control Systems and Power Systems.

PSO-2: Employment: Get employed in Public/Private sectors by applying the knowledge in the domains of design and operation of Electronic Systems, Microprocessor based control systems, Power systems, Energy auditing etc.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech. I-Sem (ECE)

ELECTRICAL ENGINEERING LABORATORY(20A02303P)

COURSE OUTCOMES

C217.1	Determine the various parameters experimentally
C217.2	Predetermine the efficiency and regulation of a 1-ϕ transformer
C217.3	Able to conduct and analyze the load test on Induction Motor
C217.4	Analyze the various characteristics of DC generators and DC motors
C217.5	Analyze experimentally various resonance circuits

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

R20 Regulations

Electronics & Communication Engineering

Course Code	ELECTRICAL ENGINEERING LAB		L	T	P	C
20A02303P			0	0	3	1.5
Pre-requisite	Fundamentals of Electrical Circuits	Semester	III			

Course Objectives:

- Understand and experimentally verify various resonance circuits
- Apply and experimentally analyze two port network parameters
- To do experiments on DC Machines
- To do experiments on AC Machines

Course Outcomes (CO):

- To determine the various parameters experimentally
- To understand various characteristics of DC generators and DC motors
- To predetermine the efficiency and regulation of a 1-ϕ transformer

Experiments

1. Response of RL, RC, and R-L-C circuits for step and pulse inputs
2. Series Resonance and its Frequency Response
3. Parallel Resonance and its Frequency Response
4. Determination of Z & Y parameters for the given two port network.
5. Determination of Transmission and Hybrid Parameters of a given two port network
6. OCC of a separately excited DC generator
7. Load characteristics of DC shunt generator
8. Load characteristics of DC shunt motor
9. Swinburne's test
10. Speed control of DC shunt motor
11. OC & SC tests on a 1-ϕ transformer
12. Load test on Squirrel cage Induction motor
13. Predetermination of regulation of alternator by Synchronous impedance method

Note: Student has to perform at least 10 experiments

Online learning resources/Virtual Labs:
https://www.vlab.co.in/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II-I Sem. (ECE) **L T P C**
0 0 3 1.5

(20A02303P) ELECTRICAL ENGINEERING LABORATORY

The following experiments are required to be conducted as compulsory experiments:

1. Series Resonance and its Frequency Response

2. Parallel Resonance and its Frequency Response

3. Determination of Z & Y Parameters for the given two port network.

4. Determination of Transmission and Hybrid Parameters of a given two port network

5. Speed control of DC Shunt Motor.

6. OCC of a separately excited DC generator

7. Load Test On 3-Ø Induction Motor.

8.Load characteristics of DC shunt generator

9. OC & SC tests on a 1-ϕ transformer

10. Swinburne's test

ADDITIONAL EXPERIMENTS

11. Determination of Coefficient of coupling

12. Brake test on a DC Shunt Motor

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List of Experiments to be conducted

ELECTRICAL ENGINEERING LABORATORY

S.NO.	NAME OF THE EXPERIMENT
1	Series Resonance and its Frequency Response
2	Parallel Resonance and its Frequency Response
3	Determination of Z & Y Parameters for the given two port network.
4	Determination of Transmission and Hybrid Parameters of a given two port network
5	Speed control of DC Shunt Motor.
6	OCC of a separately excited DC generator
7	Load Test On 3-Ø Induction Motor
8	Load characteristics of DC shunt generator
9	OC & SC tests on a 1-ϕ transformer.
10	Swinburne's test
Additional Experiments	
11	Determination of Coefficient of coupling.
12	Brake test on a DC Shunt Motor

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List of Experiments to be conducted

CONTENTS

ELECTRICAL ENGINEERING LABORATORY

GENERAL INSTRUCTIONS FOR LABORATORY CLASSES

DO'S

1. Without Prior permission do not enter into the Laboratory.
2. While entering into the LAB students should wear their ID cards.
3. The Students should come with proper uniform.
4. Students should sign in the LOGIN REGISTER before entering into the laboratory.
5. Students should come with observation and record note book to the laboratory.
6. Students should maintain silence inside the laboratory.
7. Circuit connections must be checked by the lab-in charge before switching the supply

DONT'S

8. Students bringing the bags inside the laboratory..
9. Students wearing slippers/shoes insides the laboratory.
10. Students scribbling on the desk and mishandling the chairs.
11. Students using mobile phones inside the laboratory.
12. Students making noise inside the laboratory.
13. Students mishandle the devices.
14. Students write anything on the devices

ELECTRICAL ENGINEERING LABORATORY

SCHEME OF EVALUATION

S.No	Experiment Name	Date	Marks Awarded				Total 30(M)
			Record (10M)	Observation (10M)	Viva Voce (5M)	Attendance (5M)	
1	Series Resonance and its Frequency Response						
2	Parallel Resonance and its Frequency Response						
3	Determination of Z & Y Parameters for the given two port network.						
4	Determination of Transmission and Hybrid Parameters of a given two port network						
5	Speed control of DC Shunt Motor.						
6	OCC of a separately excited DC generator						
7	OC & SC tests on a 1-ϕ transformer.						
8	Load characteristics of DC shunt generator						
9	Load Test On 3-Ø Induction Motor						
10	Swinburne's test						
ADDITIONAL EXPERIENTS							
11	Determination of Coefficient of coupling.						
12	Brake test on a DC Shunt Motor						

Signature of Lab In-charge

EXP.NO:01 DATE

CIRCUIT DIAGRAM OF SERIES RESONANCE:

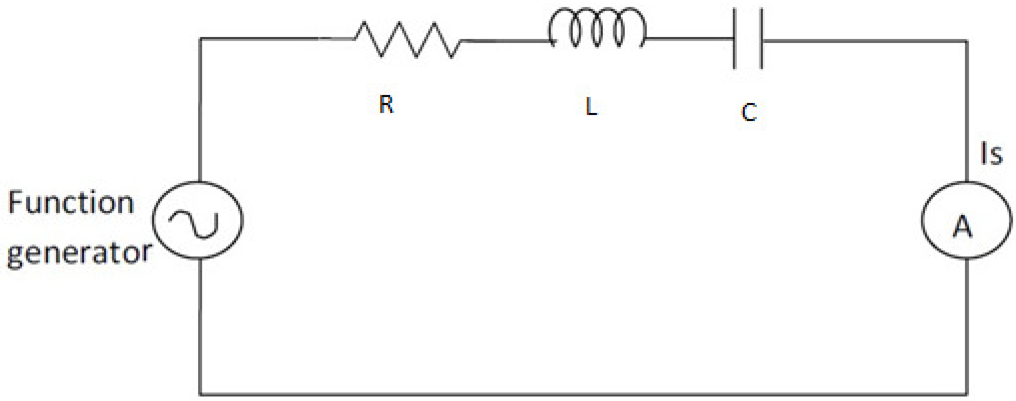
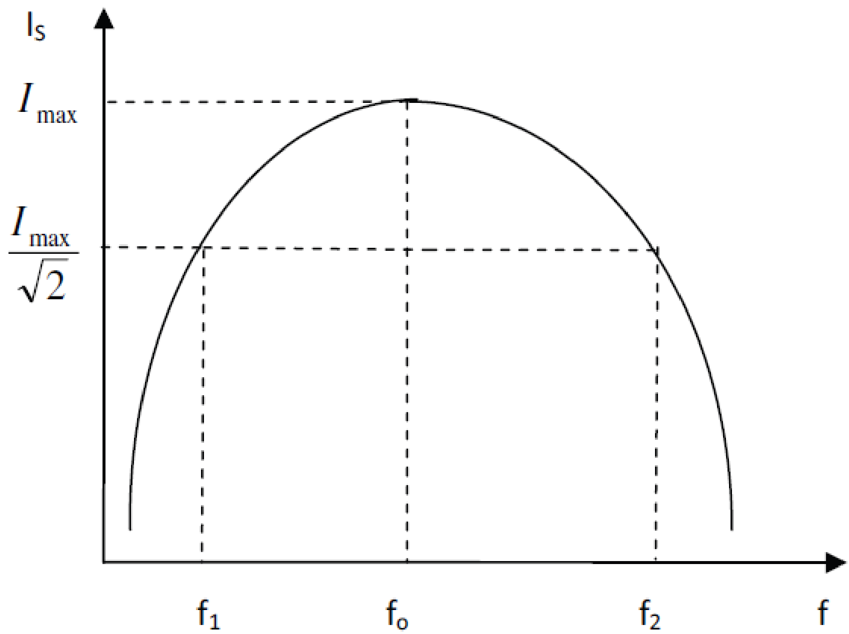


Fig-1

MODEL GRAPH:



EXP.NO:01 **DATE:**

FREQUENCY RESPONSE OF SERIES RESONANCE CIRCUIT

AIM: To verify resonant frequency, bandwidth & quality factor of RLC series Resonant circuits.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20) V_{PP}	-	1No
2	Decade inductance Box	(0-1.11H)	-	1No
3	Decade Capacitance Box	(0-1.11F)	-	1No
4	Decade Resistance Box	(0-111.11K)Ω	-	1No
5	Resistors	1k Ω	Carbon Composition	2No
6	Ammeter	(0-10m) A	MI	1No
7	Bread board	-	-	1No
8	Connecting wires	-	-	Required Number

PROCEDURE:

Series Resonant circuit

1. Set the signal generator in sine wave mode.
2. Using C.R.O set the output voltage of the signal generator to an appropriate value (Say 20 V peak to peak).
3. Connect the circuit as per fig (1.1).
4. Vary the frequency of the input signal in steps and note down the corresponding current through the circuit and tabulate the readings.
5. Reduce the frequency to zero.
6. Now decrease the resistance to 500 Ω and repeat the steps 4 and 5.
7. Reduce the signal generator voltage to 0V and switch off the supply.
8. Disconnect the circuit and plot the graph by relating dependent and independent variables.
9. The frequency corresponding to maximum current will be the resonant frequency.

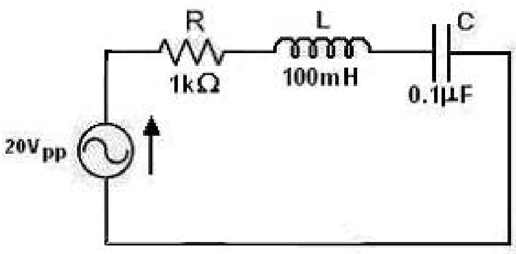
10. Draw a line parallel to X-axis, corresponding to 0.707 I_{max}, which cuts the curve at two points.
11. The frequencies corresponding to those points are called as cut-off frequencies.
12. The difference between lower and upper cut-off frequencies gives the bandwidth.

PRECAUTIONS:

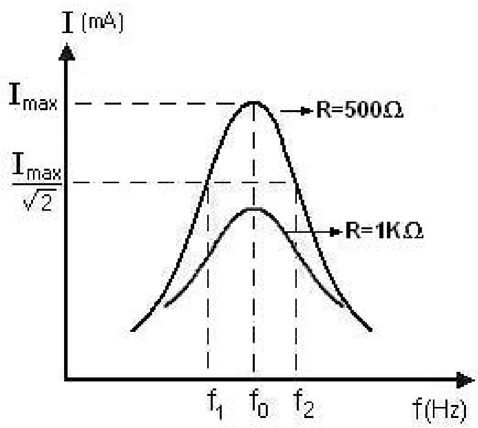
1. Keep the output voltage of the signal generator in zero volt position.
2. Set the ammeter pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.

SERIES RESONANCE

GIVEN CIRCUIT

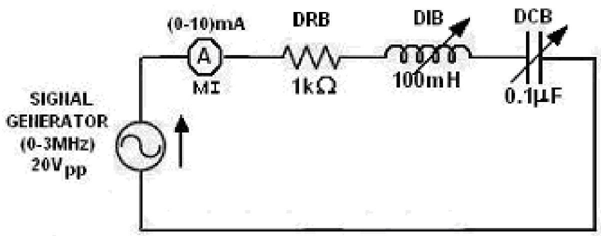


MODEL GRAPH



Theoretical Circuit diagram:

Practical circuit diagram:



Resonant frequency, $f_0 = \frac{1}{2\pi\sqrt{LC}}$.

Quality factor, $Q = \frac{\omega L}{R} = \frac{1}{\omega CR} = \frac{1}{R}\sqrt{\frac{L}{C}} = 1$

Band width =

Resonant frequency, f_0 =

Lower cut-off frequency, f_1 =

Upper cut-off frequency, f_2 =

Band width = $f_2 - f_1$ =

Quality factor, $Q = \frac{f_o}{f_2 - f_1}$

Fig (1.1)

Tabular Column:

When R = 1KΩ

S. No	Frequency, f (Hz)	Current, I (mA)

When R = 500Ω

S. No	Frequency, f (Hz)	Current, I (mA)

RESULT:

The resonant frequency, bandwidth and quality factor of the given series and parallel resonant circuits are determined and compared with the theoretical values.

S.No	Parameter	Series Resonant circuit	
		Theoretical Values	Practical Values
1	Resonant Frequency, f_o		
2	Band width		
3	Quality factor		

CONCLUSIONS:

1. Since the current at resonance is maximum, the series resonant circuit is called as acceptor circuit.
2. As the resistance of the circuit decreases, the Q-factor increases and selectivity of the circuit will be better.
3. Since the current at resonance is minimum, the parallel resonant circuit is called as rejector circuit.
4. The variation of the resistance does not affect the resonant frequency.

VIVA QUESTIONS:-

1) Define Resonance?

2) Define bandwidth?

3) What is resonant condition in series RLC circuit?

4) Define quality factor?

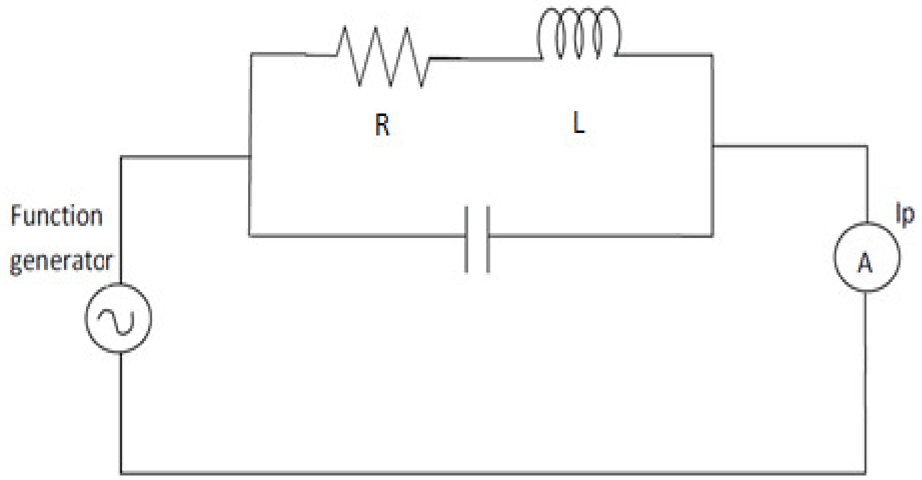
5) What is half power frequencies?

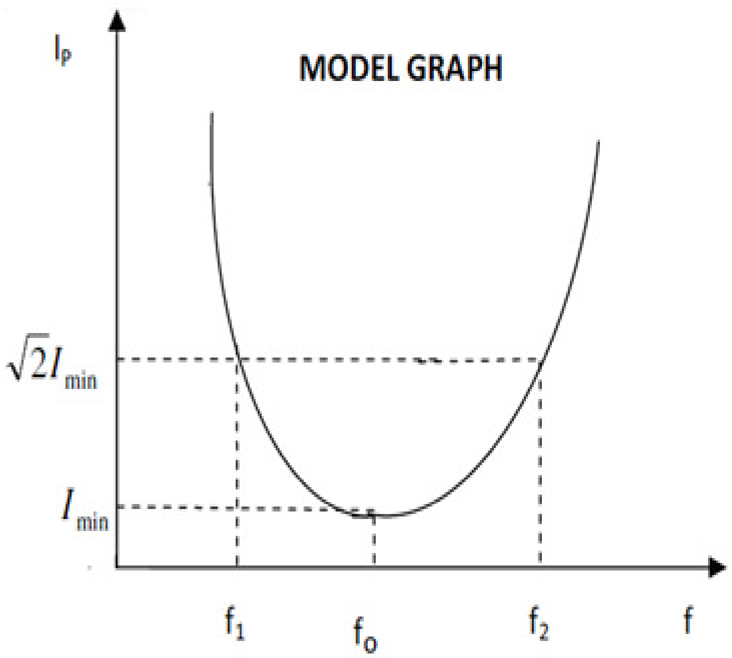
6) What is the resonance frequency of series RLC circuit?

7) What is the band width of series RLC circuit?

8) What are the half power frequencies of series RLC circuit?

Circuit Diagram:





EXP.NO:02 **DATE:**

FREQUENCY RESPONSE OF PARALLEL RESONANCE CIRCUIT

AIM: To verify resonant frequency, bandwidth & quality factor of RLC parallel Resonant circuits.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Signal generator	(0 – 3M)Hz, (0-20) V_{PP}	-	1No
2	Decade inductance Box	(0-1.11H)	-	1No
3	Decade Capacitance Box	(0-1.11F)	-	1No
4	Decade Resistance Box	(0-111.11K)Ω	-	1No
5	Resistors	1k Ω	Carbon Composition	2No
6	Ammeter	(0-10m) A	MI	1No
7	Bread board	-	-	1No
8	Connecting wires	-	-	Required Number

PROCEDURE:

Resonance in parallel RLC circuit

1. Connect the circuit as per fig .
2. Vary the frequency of the input signal in steps and note down the corresponding current through the circuit and tabulate the readings.
3. Reduce the frequency to zero.
4. Now decrease the resistance to 500 Ω and repeat the steps 4 and 5.
5. Reduce the signal generator voltage to 0V and switch off the supply.
6. The frequency corresponding to minimum current will be the resonant frequency.
7. Draw a line parallel to X-axis, corresponding to 1.414 I_{min}, which cuts the curve at two points.
8. The difference between lower and upper cut-off frequencies gives the bandwidth.

PRECAUTIONS:

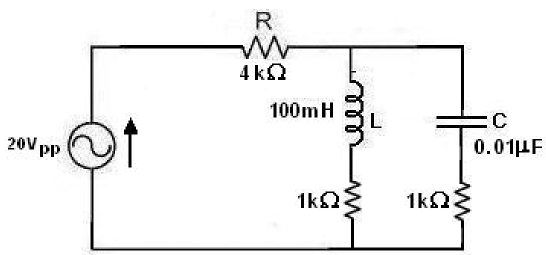
1. Keep the output voltage of the signal generator in zero volt position.
2. Set the ammeter pointer at zero position.
3. Take the readings with out parallax error.
4. Avoid loose connections.

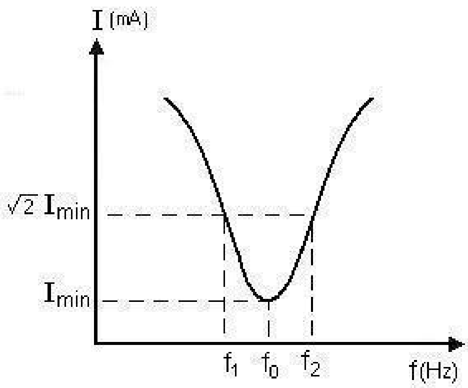
SERIES RESONANCE

GIVEN CIRCUIT MODEL GRAPH

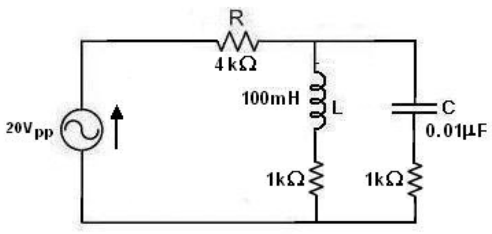
PARALLEL RESONANCE

GIVEN CIRCUIT: **MODEL GRAPH:**





Theoretical Circuit diagram:



Resonant frequency, f_0 ,

$$f_0 = \frac{1}{2\pi\sqrt{LC}}\sqrt{\frac{CR_L^2 - L}{CR_C^2 - L}}\ .$$

$\because R_L = R_C$, $f_0 = \frac{1}{2\pi\sqrt{LC}}$ =.

Quality factor, Q =.

Band width =.

Practical circuit diagram:

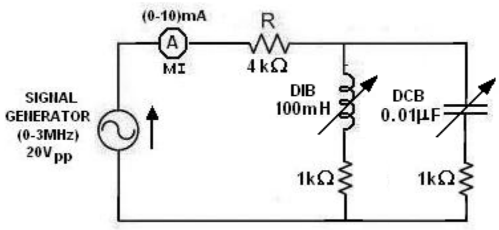


Fig (1.2)

Tabular Column:

S. No	Frequency, f (Hz)	Current, I(mA)

f_0 = f_1= f_2=

Band width = $f_2 - f_1$ =

$$Q = \frac{f_o}{f_2 - f_1} =$$

RESULT:

The resonant frequency, bandwidth and quality factor of the given series and parallel resonant circuits are determined and compared with the theoretical values.

S.No	Parameter	Parallel Resonant circuit	
		Theoretical Values	Practical Values
1	Resonant Frequency, f_o		
2	Band width		
3	Quality factor		

CONCLUSIONS:

1. Since the current at resonance is maximum, the series resonant circuit is called as acceptor circuit.
2. As the resistance of the circuit decreases, the Q-factor increases and selectivity of the circuit will be better.
3. Since the current at resonance is minimum, the parallel resonant circuit is called as rejector circuit.
4. The variation of the resistance does not affect the resonant frequency.

VIVA QUESTIONS:-

1) Define Resonance?

2) What is the quality factor of parallel RLC circuit?

3) What is Resonant condition in series RLC circuit?

4) Define quality factor?

5) What is half power frequencies?

6) What is the resonance frequency of parallel RLC circuit?

7) What is the band width of parallel RLC circuit?

8) What are the half power frequencies of parallel RLC circuit?

EXPT NO: 03(a) DATE:

DETERMINATION OF Z PARAMETERS

AIM: To determine open circuit impedance parameters (Z) of the given two port network.

BRIEF THEORY:

In Z parameters of a two-port, the input & output voltages V1 & V2 can be expressed in terms of input & output currents I1 & I2. Out of four variables (i.e V1, V2, I1, I2) V1& V2 are dependent variables whereas I1 & I2 are independent variables. Thus,

$V_1 = Z_{11}I_1 + Z_{12} I_2$ (1)

$V_2 = Z_{21}I_1 + Z_{22} I_2$ (2)

Here Z_{11}& Z_{22} are the input & output driving point impedances while Z_{12}& Z_{21} are the reverse & forward transfer impedances.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

PRECAUTIONS:

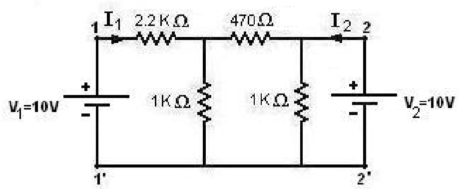
1. Initially keep the RPS output voltage knob in zero volt position.
2. Set the ammeter pointer to zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.
5. Do not short-circuit the RPS output terminals.

PROCEDURE:

1. Connect the circuit as per the fig.
2. Adjust the output voltage of the regulated power supply to an appropriate value (Say 10V).
3. Note down the corresponding current (I_1) through the input port, $1\text{-}1^1$ and voltage (V_2) across the output port, $2\text{-}2^1$.
4. Reduce the voltage to zero, disconnect the circuit and calculate Z_{11} and Z_{21} using the formulae, $Z_{11}=V_1/I_1$ and $Z_{21}=V_2/I_1$.
5. Connect the circuit as per the fig .
6. Vary the R.P.S. output voltage to 5V, 10Vand 15V
7. Reduce the voltage to zero, disconnect the circuit and calculate Z_{22} and Z_{12} using the formulae, $Z_{22}=V_2/I_2$ and $Z_{12}=V_1/I_2$

DETERMINATION OF Z PARAMETERS

GIVEN CIRCUIT:



Theoretical circuit diagrams:

a) To find Z_{11}&Z_{21}:

Practical circuit diagrams:

a) To find Z_{11}&Z_{21}:

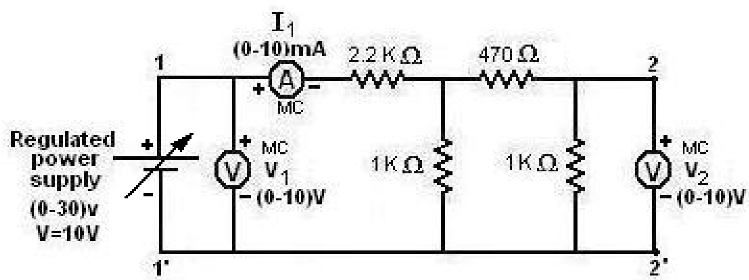


Fig.

Tabular Column:

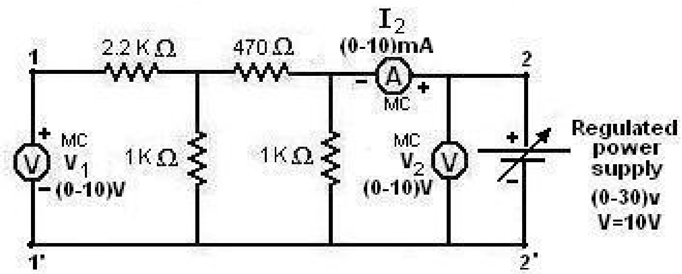
S. No	V_1 (Volts)	V_2 (Volts)	I_1 (mA)	$z_{11} = \frac{V_1}{I_1} k\Omega$	$z_{21} = \frac{V_2}{I_1} k\Omega$

Theoretical circuit diagrams:

b) **To find Z_{22}&Z_{12}:**

Practical circuit diagrams:

b) To find Z_{22}&Z_{12}:



S. No	V_1 (volts)	V_2 (volts)	I_2 (mA)	$z_{22} = \frac{V_2}{I_2} k\Omega$	$z_{12} = \frac{V_1}{I_2} k\Omega$

RESULT:

Open circuited impedance parameters are determined and are compared with theoretical values.

S.No	**Parameter**	**Theoretical Values**	**Practical Values**
1	Z_{11}		
2	Z_{12}		
3	Z_{21}		
4	Z_{22}		

CONCLUSIONS:

1. Since $Z_{12} = Z_{21}$ the given circuit is reciprocal.
2. Since $Z_{11} = Z_{22}$ the given circuit is symmetrical.
3. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.

EXPT NO:03(b) DATE:

DETERMINATION OF Y PARAMETERS

AIM: To determine Short circuit admittance parameters (Y) of the given two port network.

BRIEF THEORY :

In Y parameters of a two-port , the input & output currents I_1&I_2can be expressed in terms of input & output voltages V_1& V_2 . Out of four variables (i.e I_1, I_2, V, V_2) I_1&$I_2$are dependent variables whereas V_1& V_2 are independentvariables.

$$I_1= Y_{11}V_1+Y_{12}V_2 \text{-------------------------------------}(1)$$

$$I_2 = Y_{21}V_1+Y_{22}V_2 \text{-----------------------------------}(2)$$

Here Y_{11}& Y_{22} are the input & output driving point admittances while Y_{12}& $Y_{21}$are the reverse & forward transfer admittances.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer to zero position.

3. Take the readings without parallax error.

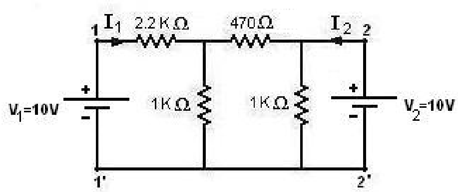
4. Avoid loose connections.

5. Do not short-circuit the RPS output terminals.

PROCEDURE:

1. Connect the circuit as per the fig.
2. Vary the R.P.S. output voltage to 5V, 10V and 15V.
3. Note down the corresponding currents through the input port I_1 and output port I_2.
4. Reduce the voltage to zero, disconnect the circuit and calculate Y_{11} and Y_{21} using the formulae, $Y_{11}=I_1/V_1$ and $Y_{21}=I_2/V_1$.
5. Connect the circuit as per the fig.
6. Vary the R.P.S. output voltage to 5V, 10V and 15V..
7. Note down the corresponding currents through the input port I_1 and output port I_2.
8. Reduce the voltage to zero, disconnect the circuit and calculate Y_{11} and Y_{21} using the formulae, $Y_{12}=I_1/V_2$ and $Y_{22}=I_2/V_2$.

GIVEN CIRCUIT:

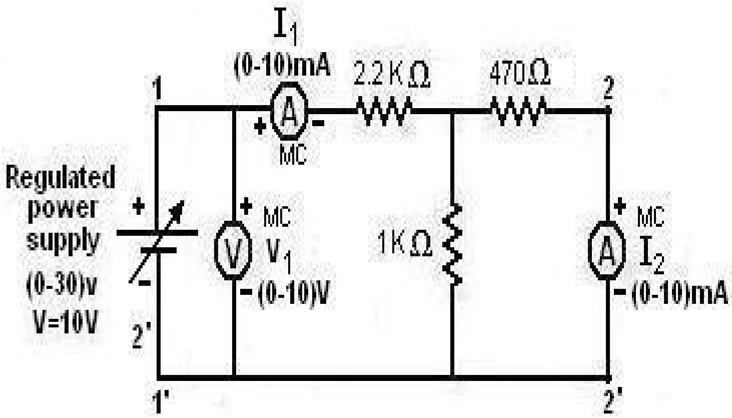


Theoretical circuit diagrams:

A) To find Y_{11}&Y_{21}:

Practical circuit diagrams:

B) To find Y_{11}&Y_{21}:



Tabular Column:

S. No	**V_1 (volts)**	**I_2 (mA)**	**I_1 (mA)**	$Y_{11} = \frac{I_1}{V_1}$ **(mho)**	$y_{21} = \frac{I_2}{V_1}$ **(mho)**

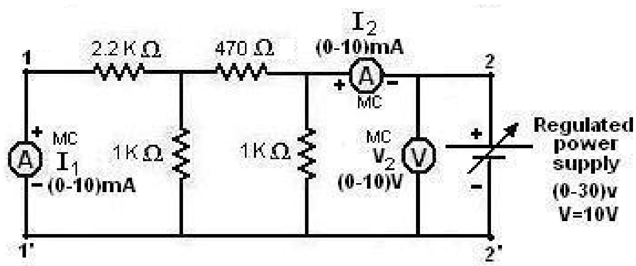
Theoretical circuit diagrams:

b)To find y_{22}&y_{12}:

∴

Practical circuit diagrams:

b) To find y_{22}&y_{12}:



S. No	V_2 (volts)	I_2 (mA)	I_1 (mA)	$y_{22} = \frac{I_2}{V_2}$ (mho)	$Y_{12} = \frac{I_1}{V_2}$ (mho)

RESULT:

Open circuited impedance and short circuit admittance parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values
1	Y_{11}		
2	Y_{12}		
3	Y_{21}		
4	Y_{22}		

CONCLUSIONS:

4. Since $Y_{12} = Y_{21}$ the given circuit is reciprocal.
5. Since $Y_{11} = Y_{22}$ the given circuit is symmetrical.
6. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.

Expt. No.: 04(a) Date:

DETERMINATION OF ABCD PARAMETERS

AIM: To determine transmission parameters (ABCD) of the given two port network.

BRIEF THEORY:

ABCD parameters are widely used in analysis of power transmission engineering where they are termed as "Circuit Parameters". ABCD parameters are also known as "Transmission Parameters". In these parameters, the voltage & current at the sending end terminals can be expressed in terms of voltage & current at the receiving end. Thus,

$V_1=AV_2+B(-I_2)$

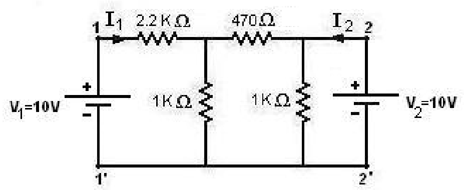
$I_1 = CV_2 + D(-I_2)$

Here "A" is called reverse voltage ratio, "B" is called transfer impedance "C" is called transfer admittance & "D" is called reverse currentratio.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

Given Circuit



Theoretical circuit diagrams:

b) <u>To find B&D</u>:

Practical circuit diagrams:

b) <u>To find B&D:</u>

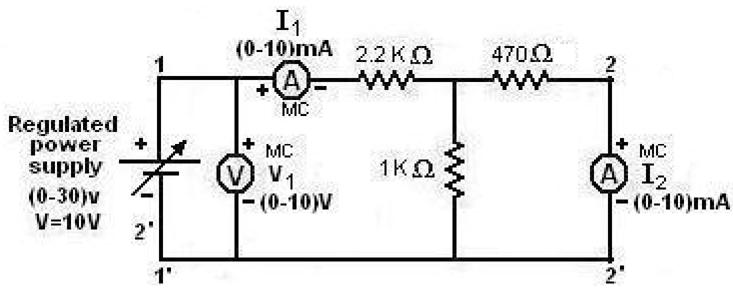


Fig.

<u>Tabular Column:</u>

S. No	V_1 (volts)	I_2 (mA)	I_1 (mA)	$B = \frac{V_1}{I_2}$ (kΩ)	$D = \frac{I_1}{I_2}$

Theoretical circuit diagrams:

b) To find A&C:

Practical circuit diagrams:

b) To find A & C:

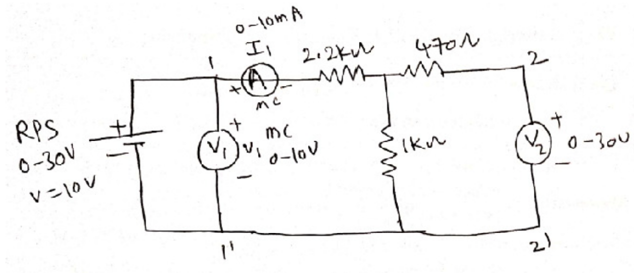


Fig.

Tabular Column:

S. No	V_1 (Volts)	V_2 (Volts)	I_1 (mA)	**A=$\frac{V1}{V2}$**	**C=$\frac{I1}{V2}$**

PROCEDURE:

1. Connect the circuit as per the fig.

2. Adjust the output voltage of the regulated power supply to an appropriate value (Say 10V).

3. Note down thecorresponding current (I_1) through the input port, $1\text{-}1^1$ and voltage (V_2) across the output port, $2\text{-}2^1$.

4. Reduce the voltage to zero, disconnect the circuit and calculate A and C using the formulae, A=v1/v2 and C=I1/V2.

5. Connect the circuit as per the fig.

6. Vary the R.P.S. output voltage to 5V, 10Vand 15V

7. Note down the corresponding current (I_2) through the output port $2\text{-}2^1$ and voltages (V_1& V_2) across the input port $1\text{-}1^1$& output port 2.2^1resp'y.

8. Reduce the voltage to zero, disconnect the circuit and calculate B and D using the formulae, B=V1/I2and $D=I_1/I_2$

9. Connect the circuit as per the fig.

10. Vary the R.P.S. output voltage to 5V, 10V and 15V.

11. Note down the corresponding currents through the input port I_1 and output port I_2.

12. Reduce the voltage to zero, disconnect the circuit and calculate h_{11} and h_{21} using the formulae,$h_{11}=V_1/I_1$ and $h_{21}=I_2/I_1$.

13. Connect the circuit as per the fig.

14. Vary the R.P.S. output voltage to 5V, 10V and 15V..

15. Note down the corresponding currents through the input port I_1 and output port I_2.

16. Reduce the voltage to zero, disconnect the circuit and calculate h_{22} and h_{12} using the formulae,$h_{22}=I_2/V_2$ and $h_{12}=V_1/V_2$.

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer to zero position.

3. Take the readings without parallax error.

4. Avoid loose connections.

5. Do not short-circuit the RPS output terminals.

RESULT:

Transmission parameters are determined and are compared with theoretical values.

S.No	Parameter	Theoretical Values	Practical Values
1	A		
2	B		
3	C		
4	D		

Expt. No.: 04(b) Date:

DETERMINATION OF H PARAMETERS

AIM: To determine hybrid parameters (h) of the given two port network.

BRIEF THEORY:

In 'h' parameters of a two port network, voltage of the input port and the current of the output port are expressed in terms of the current of the input port and the voltage of the output port. Due to this reason, these parameters are called as 'hybrid' parameters, i.e. out of four variables (i.e. $V_{1,}$ V2, I1, I2) $V_{1,}$ I_2 are dependent variables.

Thus,

V1= h11I1 +h12V2 -- (1)

$I_2 = h_{21}I_1+h_{22}V_{22}$ ---(2)

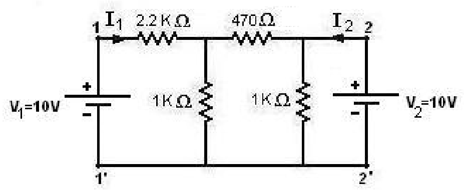
H_{11} and H_{22} are input impedance and output admittance.

H_{21} and H12 are forward current gain and reverse voltage gain.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Dual channel Regulated power supply	(0 – 30)V	-	1
2	Voltmeters	(0-10) V	MC	2
3	Ammeters	(0-10m) A	MC	2
4	Resistors	1k Ω 2.2 KΩ 470Ω	Carbon Composition	2 1 1
5	Bread board	-	-	1
6	Connecting wires	-	-	Required Number

Given Circuit



Theoretical circuit diagrams:

a) To find h_{11} & h_{21}:

$\because h11 = \frac{V_1}{I_1} =$

$\because h21 = \frac{I_2}{I_1} =$

Practical circuit diagrams:

a) To find h_{11} & h_{21}

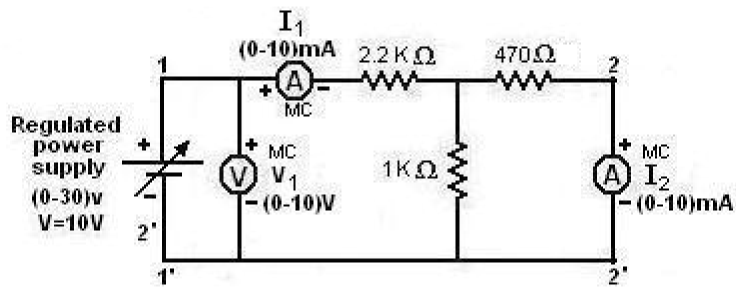


Fig.

Tabular Column:

S. No	V_1 (volts)	I_2 (mA)	I_1 (mA)	$h11 = \frac{V_1}{I_1}$ (kΩ)	$h21 = \frac{I_2}{I_1}$

) To find h_{12} & h_{22}:

$$h_{12} = \frac{V_1}{V_2}$$

$$h_{22} = \frac{I_2}{V_2}$$

) To findh_{12} & h_{22}:

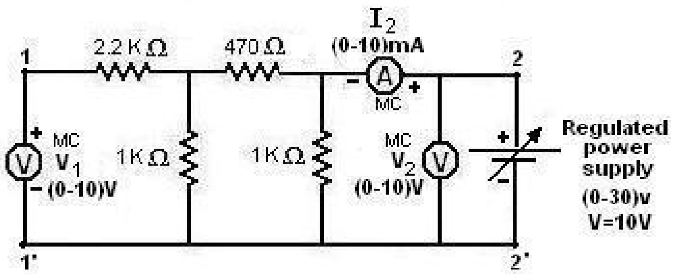


Fig. (3.4)

S. No	V_1 (volts)	V_2 (volts)	I_2 (mA)	$h12 = \frac{V_1}{V_2}$	$h22 = \frac{I_2}{V_2}$

PROCEDURE:

1. Connect the circuit as per the fig.

2. Vary the R.P.S. output voltage to 5V, 10V and 15V.

3. Note down the corresponding currents through the input port I_1 and output port I_2.

4. Reduce the voltage to zero, disconnect the circuit and calculate h_{11} and h_{21} using the formulae,$h_{11}=V_1/I_1$ and $h_{21}=I_2/I_1$.

5. Connect the circuit as per the fig.

6. Vary the R.P.S. output voltage to 5V, 10V and 15V..

7. Note down the corresponding currents through the input port I_1 and output port I_2.

8. Reduce the voltage to zero, disconnect the circuit and calculate h_{22} and h_{12} using the formulae,$h_{22}=I_2/V_2$ and $h_{12}=V_1/V_2$.

PRECAUTIONS:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer to zero position.

3. Take the readings without parallax error.

4. Avoid loose connections.

5. Do not short-circuit the RPS output terminals.

RESULT:

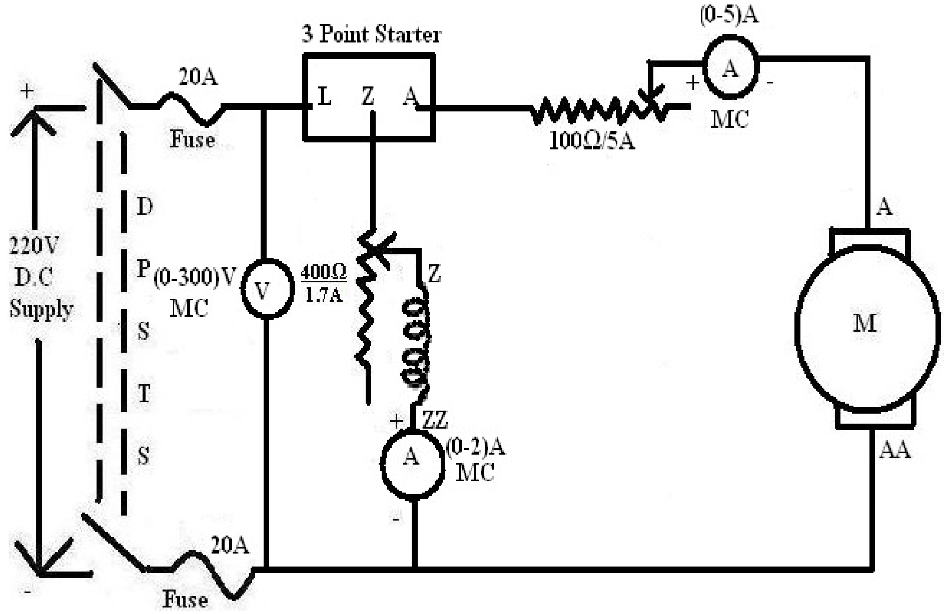
Hybrid parameters are determined and are compared with theoretical values.

S.No	**Parameter**	**Theoretical Values**	**Practical Values**
1	h_{11}		
2	h_{12}		
3	h_{21}		
4	h_{22}		

CONCLUSIONS:

1. Since $Z_{12} = Z_{21}$ and $Y_{12} = Y_{21}$ the given circuit is reciprocal.
2. Since $Z_{11} = Z_{22}$ and $Y_{11} = Y_{22}$ the given circuit is symmetrical.
3. There is a small deviation between theoretical and practical values because internal resistances of source and meters are not considered.

Circuit Diagram:



Expt. No.: 05 Date:

SPEED CONTROL OF A D.C SHUNT MOTOR

Aim:

To obtain the speed characteristics of D.C Shunt Motor by

1. Armature Controlled Method.
2. Field Controlled Method.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Voltmeter	(0-300)V	MC	1
2	Ammeter	(0-2)A	MC	1
		(0-5)A	MC	1
3	Rheostat	400Ω/1.7A	Wire Wound	1
		100 Ω/5A	Wire Wound	1
4	Tachometer	(0-9999)rpm	Digital	1
5	Connecting Wires	-	-	Required Some

Precautions:

1. Field rheostat must be kept in minimum resistance position.
2. Armature rheostat must be kept in maximum resistance position.
3. Starter arm must be in OFF position.

Procedure:

Armature Controlled Method:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions switch ON 220V D.C supply.
3. Start the motor with the help of starter.
4. By adjusting the field rheostat set the field current to a constant value.
5. By adjusting the armature rheostat for an armature voltage note down the speed and voltmeter readings.
6. Repeat step 5 for another constant field current.

Field Controlled Method:

1. By adjusting the armature rheostat set the voltage to a constant value.
2. By adjusting the field rheostat for a field current note down the speed and armature current readings.
3. Repeat the above step for another constant armature voltage.

Tabular Columns:

Armature Controlled Method:

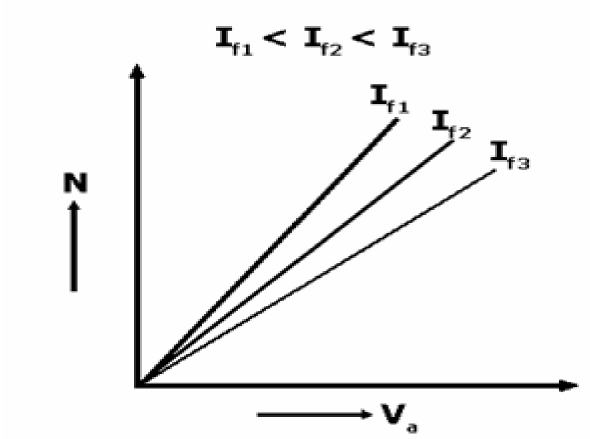
Field Current=0.8A		Field Current=0.6A	
V_a (V)	Speed (rpm)	V_a (V)	Speed (rpm)

Field Controlled Method:

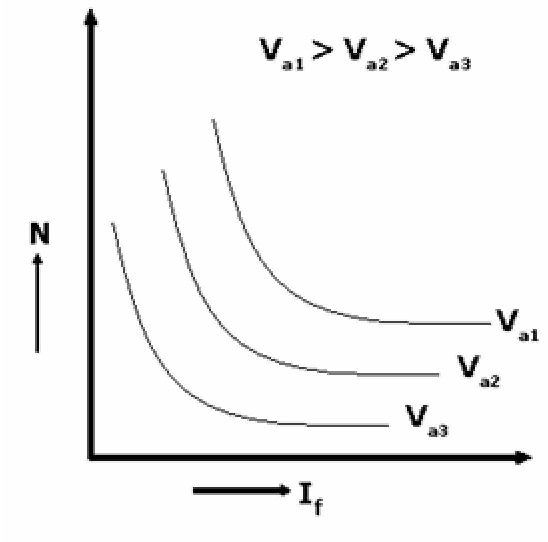
Armature Voltage=160V		Armature Voltage=200V	
I_f (A)	Speed (rpm)	I_f (A)	Speed (rpm)

Model Graphs:

Armature Controlled Method:



Field Controlled Method:

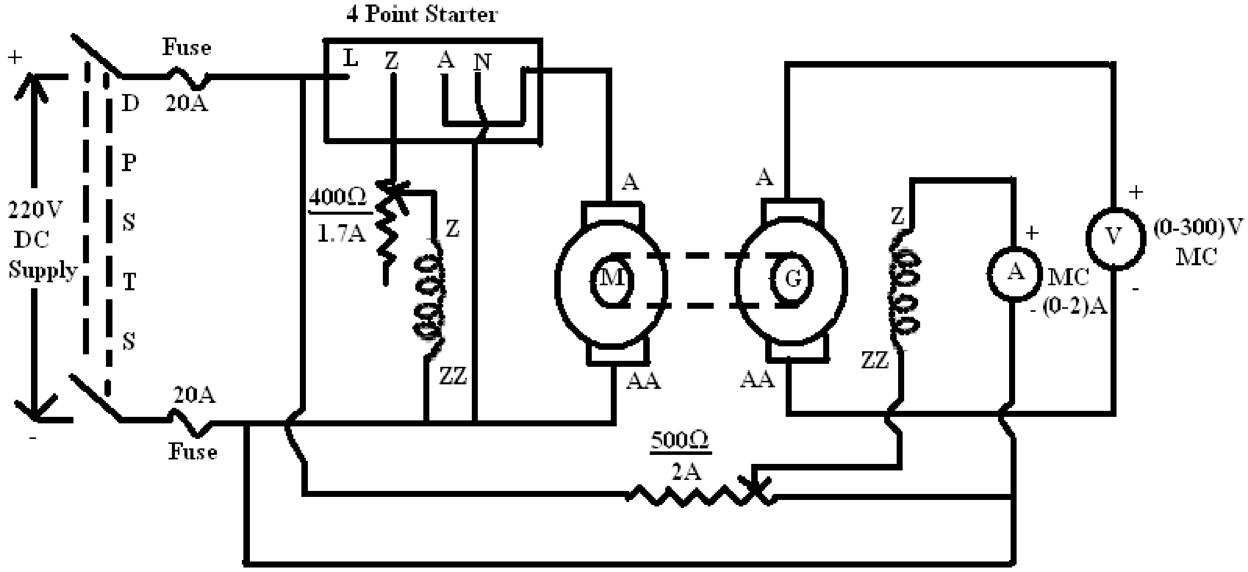


Result:

VIVA VOICE QUESTIONS:

1) What is speed equation of DC shunt motor?
2) What is the no load speed of DC shunt motor?
3) What are the various speed control techniques of a dc motor?
4) Why DC shunt motor is called Constant speed motor?
5) What happens when the field of dc shunt motor gets open circuited during running condition?
6) Why field rheostat is kept minimum position at starting condition?
7) Which method we can obtain speed of motor is above its rated speed?
8) Which method we can obtain speed of motor is below its rated speed?
9) what versus we can draw speed curve field controlled method?
10) what versus we can draw speed curve armature controlled method?

Circuit Diagram:



Expt. No.: 06 Date:

OPEN CIRCUIT CHARACTERISTICS OF A D.C GENERATOR

Aim:

To find critical field resistance of a separately excited D.C generator from its open circuit characteristics.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Voltmeter	(0-300)V	MC	1
2	Ammeter	(0-2)A	MC	1
3	Rheostat	400Ω/1.7A	Wire Wound	1
		500Ω/2A	Wire Wound	1
4	Tachometer	(0-9999)rpm	Digital	1
5	Connecting Wires	-	-	Required Some

Precautions:

1. Motor field rheostat must be kept in minimum resistance position.
2. Potential Divider must be kept in maximum resistance position.
3. Starter arm must be in OFF position.

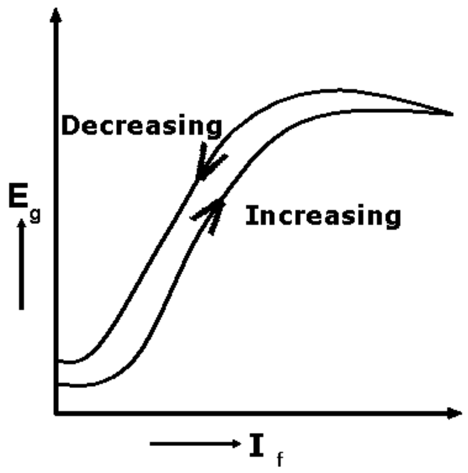
Procedure:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions close the DPST Switch and switch ON 220V D.C supply.
3. Start the Motor Generator set with the help of starter.
4. Adjust the speed of the Motor Generator Set to rated speed value by adjusting motor field rheostat.
5. Increase the excitation of the generator in steps by adjusting the potential divider and note down the corresponding voltmeter and ammeter readings.
6. Take the readings up to a value little higher than the rated voltage of the generator.
7. Again decrease the excitation in the same steps till field current is zero by adjusting the potential divider noting down the corresponding voltmeter and ammeter readings.
8. Observing the precautions switch OFF the supply.

Tabular Column:

S. No.	I_f (A)	E_g(V) Increasing	E_g (V) Decreasing
1			
2			
3			
4			
5			
6			
7			
8			

Model Graph:



Result:

VIVA VOICE QUESTIONS:

1) Why the magnetization curve is a non linear curve?
2) What is critical Speed and Critical Resistance?
3) What are conditions to failure the self excitation?
4) What are the different methods of excitations?
5) Magnetization curves are also known as?
6) What are the characteristics of a dc generator?
7) What is Residual magnetism?
8) What is meant by magnetic saturation?
9) What is meant by the field flashing method?
10) What is meant by the residual voltage?
11) Why saturation curve for DC generator does not start with zero?
12) What is Open Circuit Characteristics of DC generator?

Exp. No.: 07 **Date:**

LOAD TEST ON 3-Ø INDUCTION MOTOR

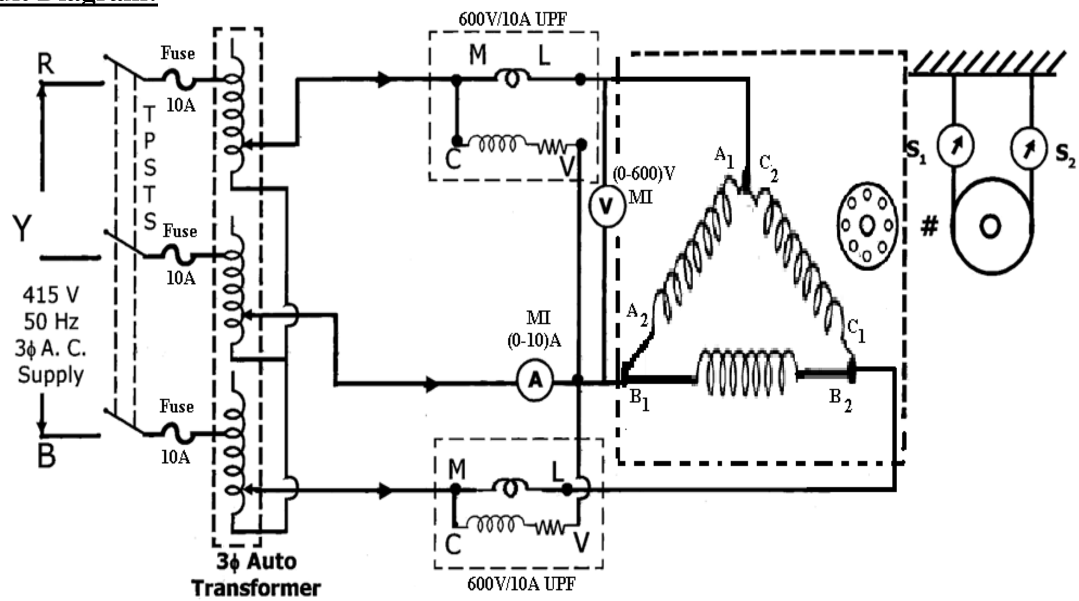
Aim:

To conduct load test on the given 3-Φ induction motor and to plot its performance characteristics.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	3- Ø Variac	415V/(0-470)V	-	1
2	Ammeter	(0-10)A	MI	1
3	Voltmeter	(0-600)V	MI	1
4	Wattmeter	600V/10A	UPF	2
5	Tachometer	(0-10000)rpm	Digital	1
6	Connecting Wires	-	-	Required Some

Circuit Diagram:



Name plate details:

Precautions:

1. 3-Ø Variac should be in minimum position.
2. Avoid loose connections

Procedure:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions close the TPST Switch and switch ON 440V A.C supply.
3. Apply the rated voltage to the stator windings of 3-Ø Induction Motor with the help of 3-Φ Auto-transformer.
4. Note down the readings of wattmeter, ammeter and voltmeter on no-load.
5. Load the Induction Motor in steps using the brake-drum arrangement. At each step note down the readings of all meters, speed and spring balance readings till full load current.
6. Gradually releasing the load and stop the motor.
7. Observing the precautions switch OFF the supply

Tabular Column:

S. No.	Line voltage V_L (V)	Line current I_L (A)	Wattmeter Readings (W)		Speed N (rpm)	Spring Balance Reading			%Slip	Power Factor	Torque (N-m)	Input power (w)	Output (W)	ŋ (%)
			W_1 (W)	W_2 (W)		S_1	S_2	S_1~S_2						
1														
2														
3														
4														
5														
6														

Formulae:

Torque, $T_{sh} = 9.81\,(S_1 \sim S_2)\,R$ N-m

Input Power, $W_{inp} = W_1 + W_2$ W

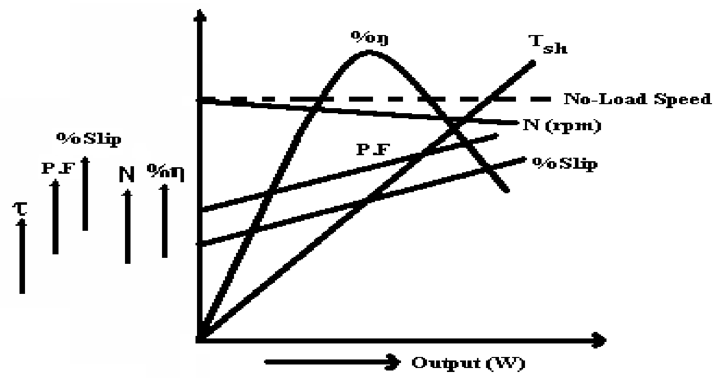
Output Power, $W_{out} = (2\pi N T_{sh})/60$ W

$\%Slip = \frac{N_s - N}{N_s} \times 100$

$\cos Ø = \frac{W_{out}}{\sqrt{3}\, V_L I_L}$

Efficiency = %ŋ = (Output/Input) X 100

Model Graph:



Calculations:

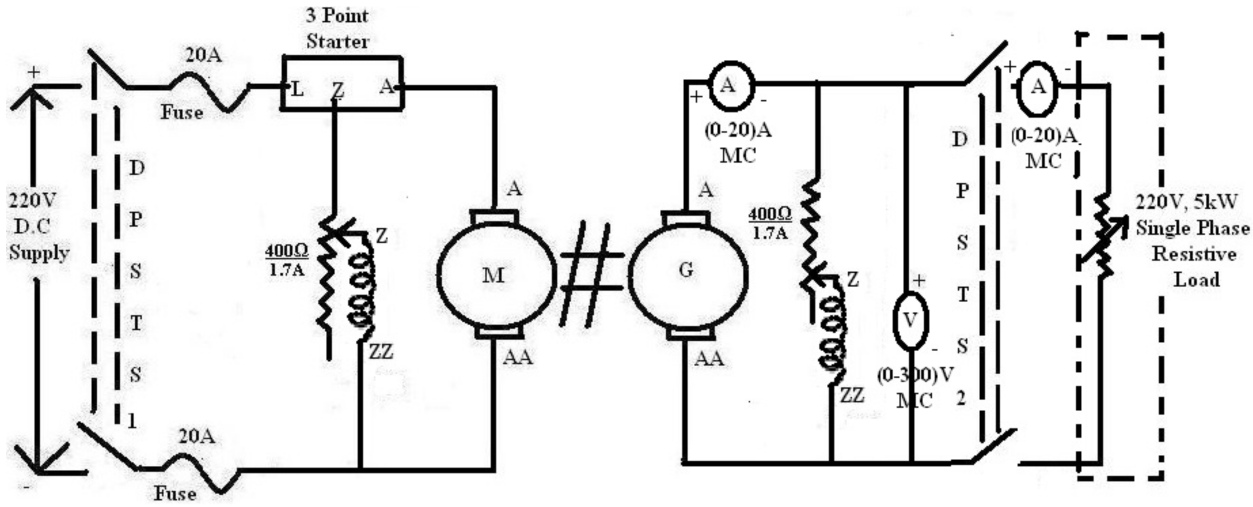
.

Result:

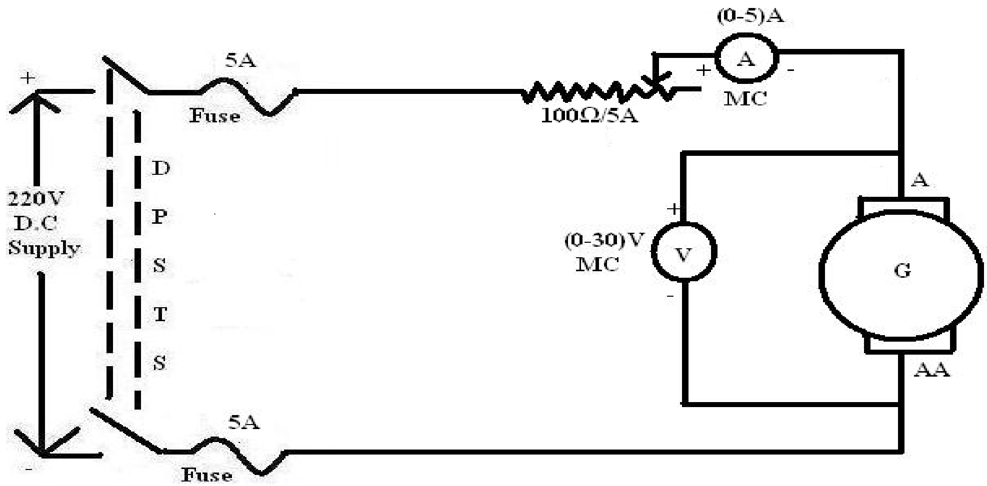
Viva Voce Questions:

1. What is meant by direct loading and indirect loading?
2. What are the limitations of direct loading?
3. What are the different types of induction motors?
4. Which type of induction motor has high starting torque?
5. Define slip.
6. Define the rated speed.
7. How the torque is developed in an induction motor.
8. How the torque and speed are related and draw the torque -slip characteristics.
9. Define synchronous speed.
10. Define synchronous watt.

Circuit Diagram:



To find Armature Resistance of the Generator:



Expt. No.: 08 Date:

LOAD TEST ON D.C SHUNT GENERATOR

Aim:

To conduct load test on a D.C Shunt Generator and to determine the internal and external characteristics.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Voltmeter	(0-300)V	MC	1
		(0-30)V	MC	1
2	Ammeter	(0-20)A	MC	2
		(0-5)A	MC	1
3	Rheostat	400Ω/1.7A	Wire Wound	2
		100Ω/5A	Wire Wound	1
4	Tachometer	(0-9999)rpm	Digital	1
5	Connecting Wires	-	-	Required Some

Precautions:

1. Field rheostat of the motor must be kept in minimum resistance position.
2. Field rheostat of the generator must be kept in maximum resistance position.
3. Armature rheostat of the generator must be kept in maximum resistance position.
4. DPST Switch on the generator side must be kept open.
5. Initially load must be in OFF position.
6. Starter arm must be in OFF position.

Procedure:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions close the DPST Switch and switch ON 220V D.C supply.
3. Start the motor-generator set with the help of starter.
4. Adjust the motor field rheostat and bring the motor to its rated speed and by varying the field rheostat of the generator apply the rated voltage of the load and close the DPSTS2 switch.
5. Now load the generator in steps till maximum rated current of the generator and note down all the meter readings.
6. Observing the precautions switch OFF the supply.

To find Armature Resistance of the Generator:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions close the DPST switch and switch ON 220V D.C Supply.
3. By adjusting the rheostat note down all the meter readings.
4. Observing the precautions switch OFF the supply.

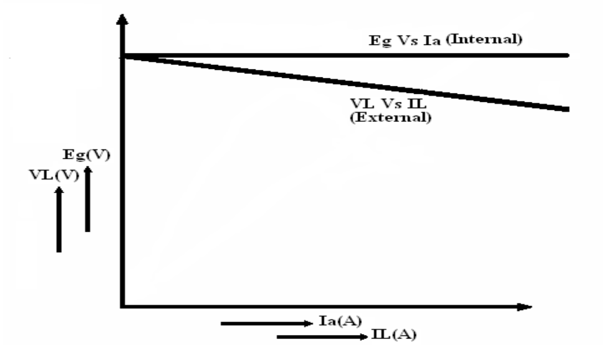
Tabular Columns:

S. No.	V (V)	I_L (A)	I_f (A)	$I_a = I_L + I_f$ (A)	$E_g = V + I_aR_a$ (V)
1					
2					
3					

To find Armature Resistance of the Generator:

S.No.	I_a (A)	V_a (V)	R_a (Ω)
1			
2			

Model Graph:



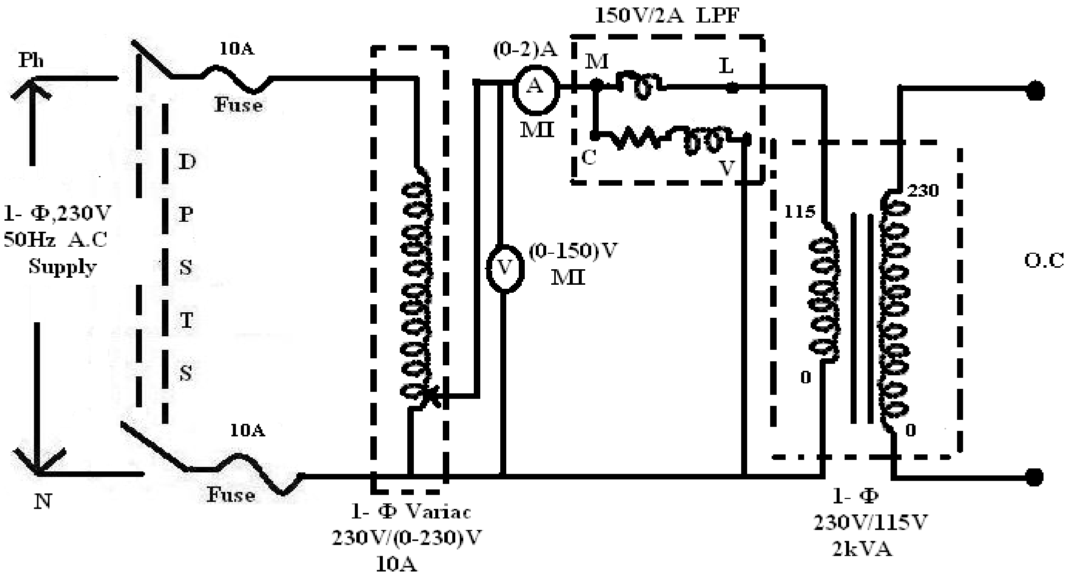
Result:

VIVA VOICE QUESTIONS:

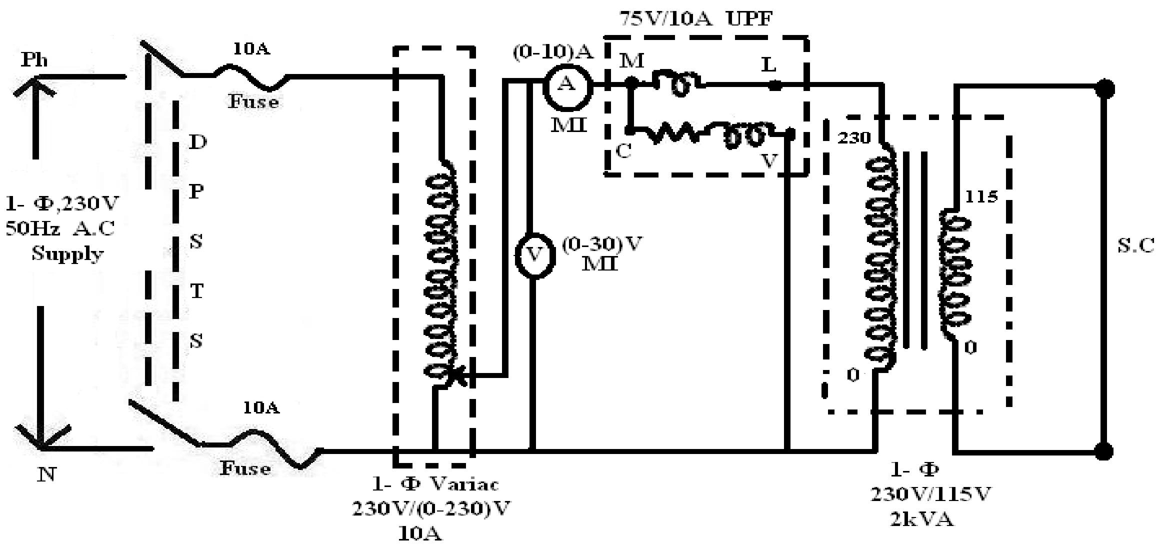
1) What is no load voltage of Dc shunt Generator?
2) What is meant DC shunt generator?
3) What is rated current of Dc shunt Generator?
4) What is the field current of DC shunt generator?
5) What versus we can draw internal characteristics of Dc shunt Generator?
6) What are the applications of DC shunt Generator?
7) What versus we can draw internal characteristics of Dc shunt Generator?
8) Why the Dc shunt Generator having drooping nature of characteristics?
9) What is armature reaction of Dc shunt Generator?

Circuit Diagram:

O.C Test:



S.C Test:



Exp. No.: 9 **Date:**

O.C & S.C TESTS ON 1-Ø TRANSFORMER

Aim:

a) To determine the efficiency and regulation of 1- Ø transformer by conducting no-load and S.C Test.
b) To draw the equivalent circuit of 1- Ø transformer referred to L.V side as well as H.V side.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	1- ØVariac	230V/(0-270)V, 10A	-	1
2	1- Ø Transformer	115V/230V, 2kVA	Core	1
3	Ammeter	(0-10)A	MI	1
		(0-2)A	MI	1
4	Voltmeter	(0-150)V	MI	1
		(0-30)V	MI	1
5	Wattmeter	150V/2A	LPF	1
		75V/10A	UPF	1
6	Connecting Wires	-	-	Required Some

Precautions:

1. Connections should be made tight.
2. 1- Ø Variac should be in minimum position.

Procedure:

1. Connect the circuit as shown in circuit diagram for O.C test.
2. Observing the precautions switch ON 1- Ø A.C supply and by using the 1-Φ variac apply the rated voltage of the primary of the transformer.
3. Note down all the meter readings. Here wattmeter reading gives iron loss.
4. Observing the precautions switch OFF the supply.
5. Connect the circuit as shown in circuit diagram for S.C test.
6. Observing the precautions switch ON 1- Ø A.C supply and by using the 1-Φ variac apply the rated current to the transformer. (Rated power of the transformer/Voltage of primary of transformer)
7. Note down all the meter readings, here wattmeter reading gives full-load copper loss.
8. Observing the precautions switch OFF the supply.

Tabular Columns:

O.C Test:

V_o (V)	I_o (A)	W_o = W X M.F (W)

S.C Test:

V_{SC} (V)	I_{SC} (A)	W_{SC} = W X M.F (W)

Efficiencies at different loads and power factor:

Load	cosθ =				cosθ =			
	Cu Loss (W)	Output (W)	Input (W)	Efficiency (%η)	Cu Loss (W)	Output (W)	Input (W)	Efficiency (%η)

Lagging Power Factor		Leading Power Factor	
Power Factor	**% Regulation**	**Power Factor**	**% Regulation**

Model Calculations:

Let the transformer be the step-down transformer (O.C Test)

Primary is H.V side and secondary is L.V side

$R_o=V_1/I_w$ (Ω) where $I_w=I_o\cos\Phi_o$

$X_o=V_1/I_\mu$ (Ω) where $I_w=I_o\cos\Phi_o$

$R_{o1}=W_{SC}/I_{SC}^2$ (Ω)

$Z_{O1}=V_{SC}/I_{SC}$

$X_{o1}=\sqrt{(Z_{O1}^2 - R_{o1}^2)}$

$R_{o2}=K^2 R_{o1}$

$X_{o2}=K^2 X_{o1}$

where,

$K=V_2/V_1$=Transformation Ratio

Calculations to find efficiency:

For example, at 1/4th full load,

Copper Losses=W_{SC} x $(1/4)^2$ (w)

where, W_{SC}=Full Load Copper Losses

Constant Losses=W_o (W)

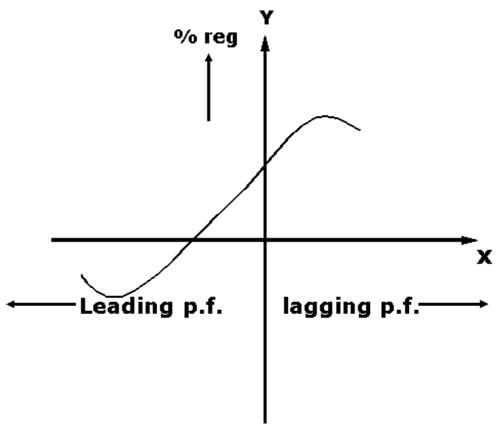
Output=(1/4) X VA X $\cos\Phi$ ($\cos\Phi$ may be assumed)

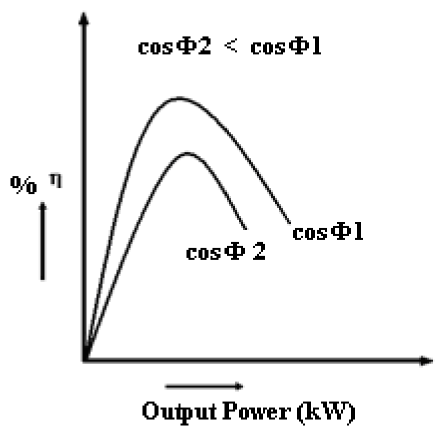
Input=Output + Copper Loss + Constant Loss

Efficiency (%η) = (Output/Input) X 100

Efficiency at different loads and power factor can be calculated.

Model Graph:





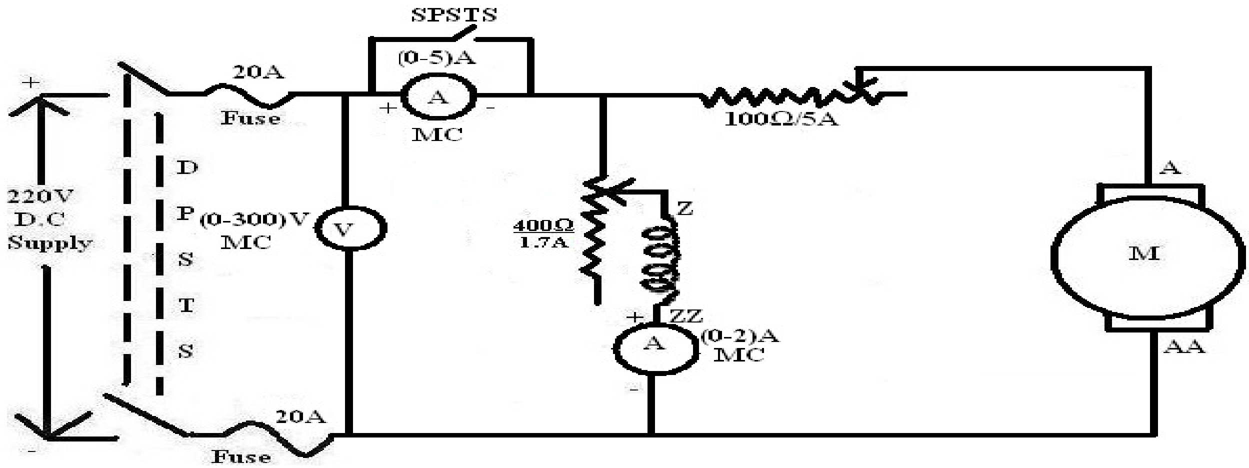
Calculations:

Result:

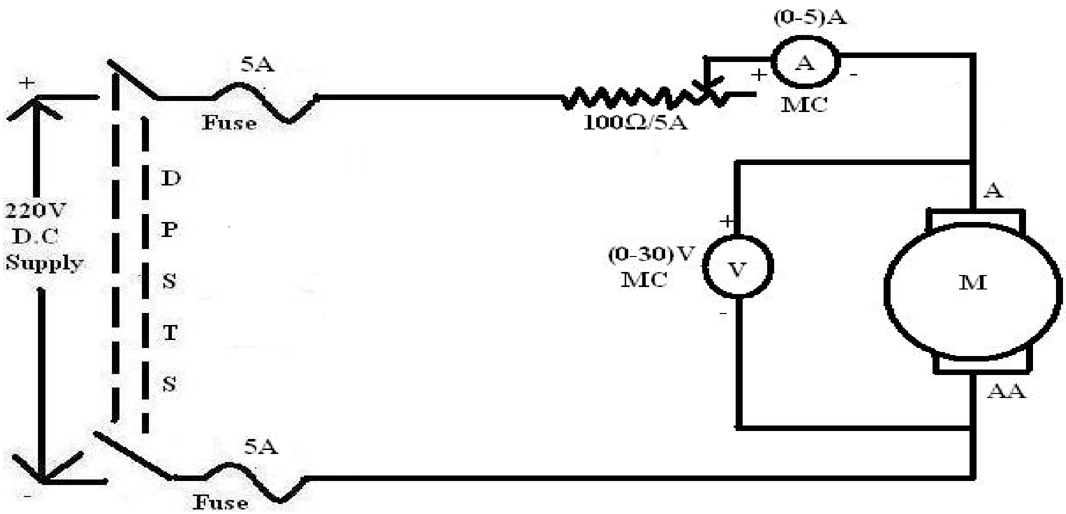
Viva Voce Questions:

1. Define transformer.
2. Distinguish the statically induced EMF and dynamically induced EMF.
3. Which losses can be determined from the O.C Test and S.C Test.
4. What is the main AIM's to conduct the O.C and S.C tests?
5. Define efficiency and voltage regulation of the transformer.
6. Why the O.C Test is conduct on L.V side.
7. Why the S.C Test is conducted on H.V side.
8. What is the difference between U.P.F and L.P.F wattcmeters?
9. No load power factor angle of transformer is around………
10. For which type of load negative voltage regulation occurs.
11. For which type of load maximum voltage regulation occurs.

Circuit Diagram:



To find Armature Resistance:



Exp. No.: 10 **Date:**

SWINBURNE'S TEST

Aim:

To predetermine the efficiency of a D.C Shunt Machine when run both as generator and motor.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Voltmeter	(0-300)V	MC	1
		(0-30)V	MC	1
2	Ammeter	(0-5)A	MC	1
		(0-2)A	MC	1
3	SPSTS	-	Knife	1
4	Rheostat	400Ω/1.7A	Wire Wound	1
		100 Ω/5A	Wire Wound	1
5	Tachometer	(0-9999)rpm	Digital	1
6	Connecting Wires	-	-	Required Some

Precautions:

1. Field rheostat must be kept in minimum resistance position.
2. Armature rheostat must be kept in maximum resistance position.
3. SPST Switch must be kept in closed position.

Procedure:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions close the DPST Switch and switch ON 220V D.C supply.
3. Adjust the speed of motor to its rated value by adjusting field and / or armature rheostat.
4. Now open the SPST Switch & note down all the meter readings.
5. Observing the precautions switch OFF the supply.

To find Armature Resistance:

1. Connect the circuit as shown in circuit diagram.
2. Keeping the rheostat in its maximum resistance position close the DPST Switch and switch ON 220V D.C Supply.
3. By adjusting the rheostat for different values of current note down the meter readings.
4. Observing the precautions switch OFF the supply.

Tabular Columns:

S. No.	Supply Voltage (V)	Line Current I_L (A)	Shunt Current I_f (A)
1			

To find Armature Resistance:

S. No.	**V_a (V)**	**I_a (A)**	**R_a (Ω)**
1			
2			
3			

Machine when run as Motor:

S. No.	**Voltage(V)**	**I_L (A)**	**I_f (A)**	**I_a (A)**	**Input (W)**	**W_{Cu} (W)**	**W_C (W)**	**Output (W)**	**Ŋ (%)**	**W_T**
1										
2										
3										
4										

Machine when run as Generator:

S. No.	**Voltage(V)**	**I_L (A)**	**I_f (A)**	**I_a (A)**	**Input (W)**	**W_{Cu} (W)**	**W_C (W)**	**Output (W)**	**Ŋ (%)**	**W_T**
1										
2										
3										
4										

Formulae:

Motor:

$I_a = I_L - I_f$

Input = $V_L I_L$

$W_C = V_L I_L - I_a^2 R_a$

$W_{Cu} = I_a^2 R_a$

$W_T = W_{Cu} + W_C$

Output = Input - W_T

Ŋ = (Output/Input) X 100

Generator:

$I_a = I_L + I_f$

Output = $V_L I_L$

$W_C = V_L I_L - I_a^2 R_a$

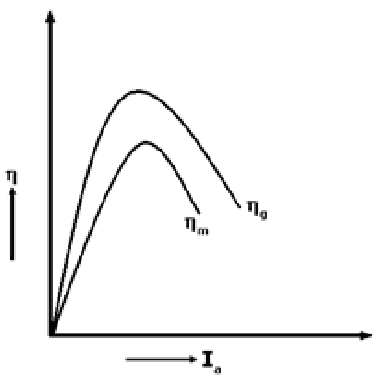
$W_{Cu} = I_a^2 R_a$

$W_T = W_{Cu} + W_C$

Input = Output + W_T

η = (Output/Input) X 100

Model Graph:



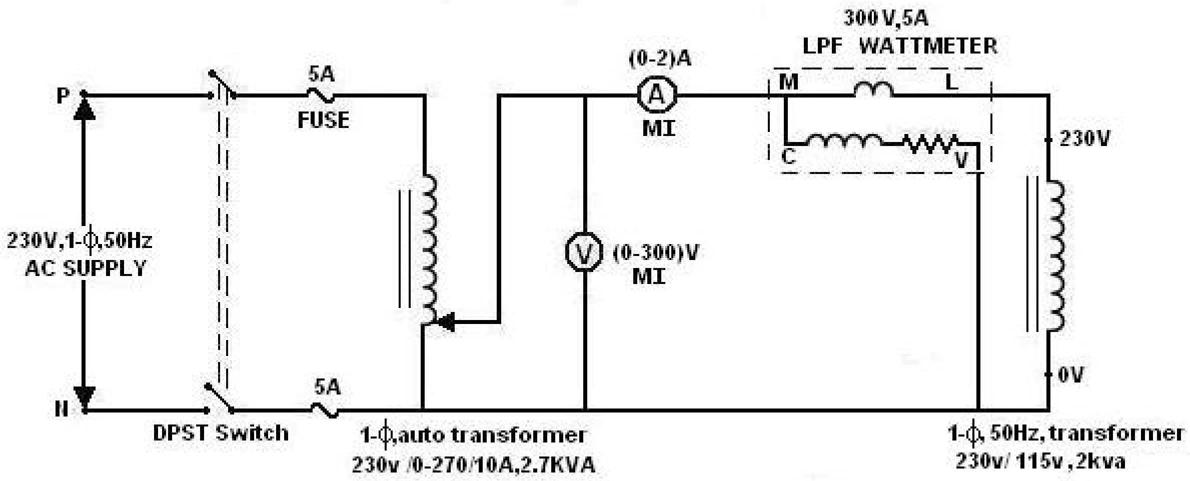
Result:

VIVA VOICE QUESTIONS:

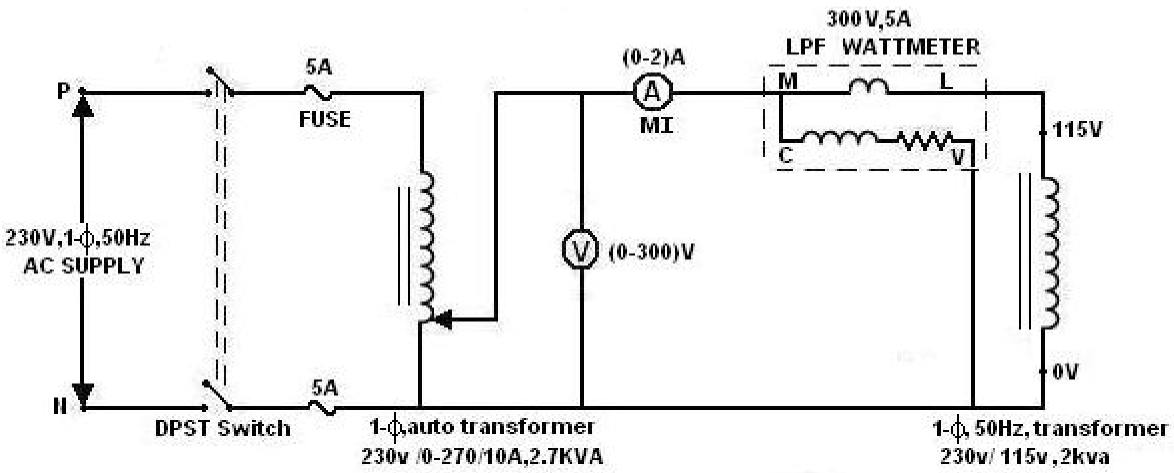
1) What is the necessity of Swinburne's test?
2) Why this test is conducted on no load?
3) Why this test is not suitable for series machines?
4) Whether the test is a direct method or indirect method?
5) What are the advantages of Swinburne's test?
6) What is meant by the efficiency?
7) What is rated current of motor as well as generator of dc shunt machine?
8) How do you estimate the half load efficiency?
9) How do you estimate the half load copper losses?
10) Explain Faradays Laws of Electro Magnetic Induction

CIRCUIT DIAGRAMS:

a) To determine the self inductance of coil 1:



b) To determine the self inductance of coil 2:



Exp. No.:11 **Date:**

DETERMINATION OF COEFFICIENT OF COUPLING

AIM: To determine the coefficient of coupling of the given 1-ϕtransformer.

APPARATUS:

S. No	Name of the apparatus	Range	Type	Quantity
1	Single phase transformer	230V / 115V, 2KVA	-	1No
2	1-ϕ auto transformer	230V / 0-270V,10A, 2.7 KVA	-	1No
3	Ammeter	(0-2) A	MI	1 No
4	Voltmeter	(0-600) / (0-300) V	MI	1No
5	Wattmeter	0-150 / 300 / 600V 2.5 / 5A, LPF	DM	1No
6	3-ϕ auto transformer	415 /0-470V, 10A, 4.7 KVA	-	1No
7	Connecting wires	-	-	Required number

PROCEDURE:

1. Connect the circuit as per the fig.
2. Apply 230V across the primary winding by varying the knob of autotransformer slowly.
3. Note down the corresponding voltmeter, ammeter, and wattmeter readings.
4. Calculate the self-inductance, L_1 of the primary coil with the help of above readings.
5. Disconnect the circuit and connect the circuit as per the fig.
6. Apply 115V across the secondary winding by varying the knob of autotransformer slowly.
7. Note down the corresponding voltmeter, ammeter, and wattmeter readings.
8. Calculate the self-inductance, L_2 of the secondary coil with the help of above readings.
9. Disconnect the circuit and connect the circuit as per the fig .
10. Apply 345V across the cumulatively coupled windings by varying the knob of 3-ϕautotransformer slowly.
11. Note down the corresponding voltmeter, ammeter, and wattmeter readings.

12. Calculate the equivalent inductance, L_A of the windings with the help of above readings.
13. Disconnect the circuit and connect the circuit as per the fig .
14. Apply 115V across the differentially coupled windings by varying the knob of 1-ϕautotransformer slowly.
15. Note down the corresponding voltmeter, ammeter, and wattmeter readings and disconnect the circuit.
16. Calculate the equivalent inductance, L_B of the windings with the help of above readings.
17. Calculate Mutual inductance M, and coefficient of coupling K, using the values of L_1, L_2, L_A, L_B.

PRECAUTIONS:

1. Ensure the minimum position of autotransformer during power on and off.
2. Set the ammeter pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.

Tabular column:

S.No	**V_1 (Volts)**	**I_1 (amp)**	**W_1 (Watt)**	$Z_1 = \frac{V_1}{I_1}\Omega$	$R_1 = \frac{W_1}{I_1^2}\Omega$	$X_{L_1} = \sqrt{Z_1^2 - R_1^2}\Omega$	$L_1 = \frac{X_{L_1}}{2\pi f}H$

Tabular column:

S.No	V_2 (Volts)	I_2 (amp)	W2 (Watt)				

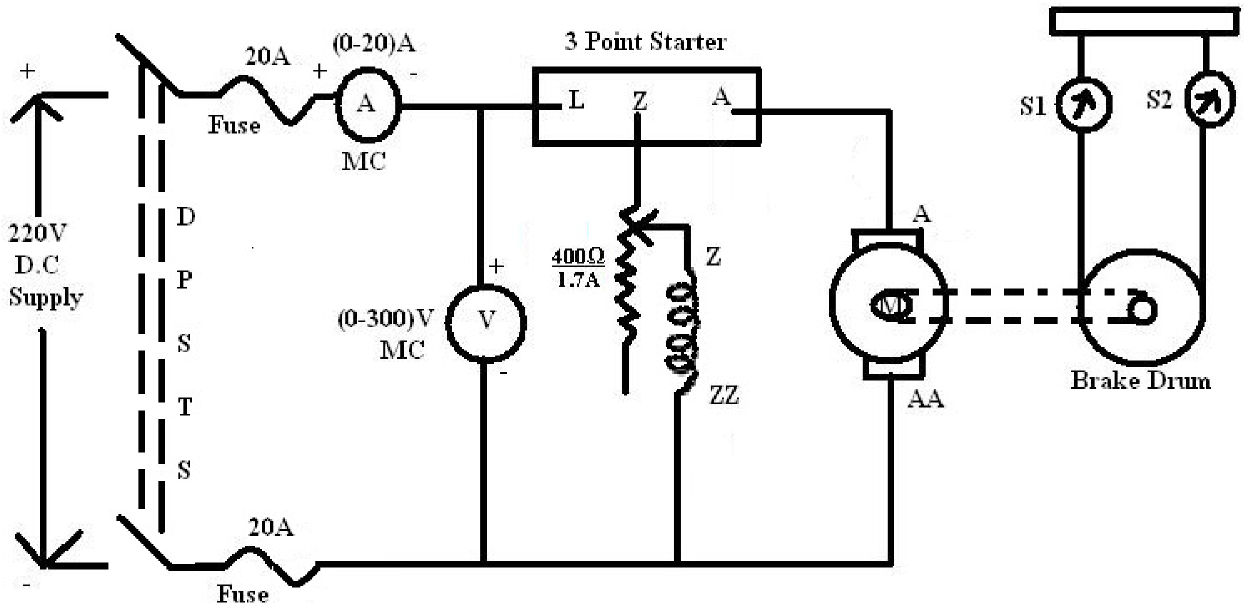
RESULT:

The coefficient of coupling K is determined for the given 1-ϕtransformer.

CONCLUSION:

The coefficient of coupling, K of the given 1-ϕ iron cored transformer is less than unity.

Circuit Diagram:



Exp. No.:12 **Date:**

BRAKE TEST ON D.C SHUNT MOTOR

Aim:

To obtain the performance characteristics of D.C Shunt Motor by direct loading.

Apparatus:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Voltmeter	(0-300)V	MC	1
2	Ammeter	(0-20)A	MC	1
3	Rheostat	400Ω/1.7A	Wire Wound	1
4	Tachometer	(0-9999)rpm	Digital	1
5	Connecting Wires	-	-	Required Some

Precautions:

1. Motor field rheostat must be kept in minimum resistance position.
2. Starter arm must be in OFF position.

Procedure:

1. Connect the circuit as shown in circuit diagram.
2. Observing the precautions switch ON 220V D.C supply.
3. Start the motor with the help of the starter.
4. By adjusting the motor field rheostat bring the motor to its rated speed.
5. Now load the motor in steps to its full load and note down all the meter readings.
6. Observing the precautions switch OFF the supply.

Tabular Column:

S. No.	V_L (V)	I_L (A)	N (rpm)	Spring Balance Reading			Torque (N-m)	Input (kW)	Output (kW)	ŋ (%)
				S_1	S_2	S_1-S_2				
1										
2										
3										
4										
5										
6										

Formulae:

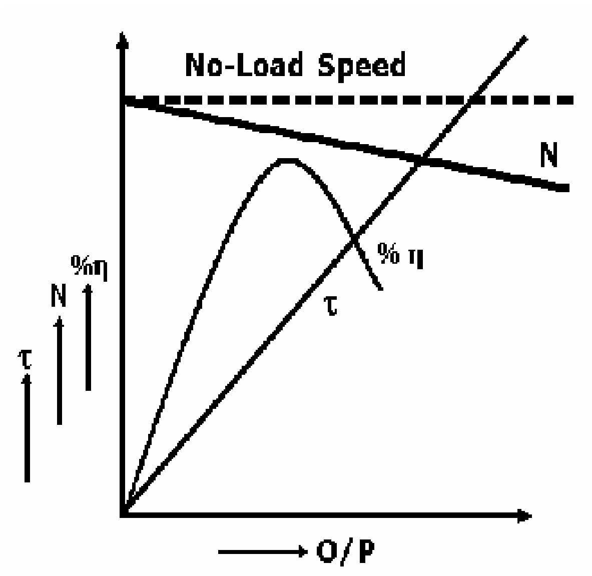
Torque = 9.81 X (S_1-S_2) X R N-m

Input = V_L I_L kW

Output = $(2\prod N)\tau/60$ kW

Efficiency = ŋ % = (Output/Input) X 100

Model Graph:



Result:

VIVA VOICE QUESTIONS:

1) What is the principle operation of DC motor?

2) What is the Range of Shunt field Resistance?

3) What is no load current of Dc shunt motor?

4) How the Direction of a motor can be reversed?

5) What is Back emf or counter EMF ?

6) Why the Shunt motor is called a constant speed motor?

7) What are the applications of DC shunt motor?

8) What is purpose of starter?

9) What meant by the DPDTS?

10)What is the output power the dc motor?