



AMSM

Lab Manual

Course Code: EEPC210

Prepared By:

Electrical Department

GP Sambalpur

LABORATORY MANUAL

Course Name: AC Machines and Special Electrical Machines

Course Code: EEPC210 **Semester:** [Insert Semester] **Branch:** Electrical Engineering

CERTIFICATE

This is to certify that Mr./Ms. _____
Roll No. _____ of _____ Semester, Diploma in Electrical
Engineering has satisfactorily completed the term work in the subject **AC Machines and
Special Electrical Machines (EEPC210)** for the academic year 20__ - 20__.

Date: _____

Subject Teacher \t\t Head of Department \t\t Principal

INDEX

Exp. No.	Name of Experiment	Date Signature
1	Identify parts of Single Phase and Three Phase Induction Motors	
2	Connect and run Three Phase IM using DOL and Star-Delta Starters	
3	Direct Load Test on Three Phase Squirrel Cage Induction Motor	
4	No-Load and Blocked-Rotor Tests on Three Phase IM	
5	Speed Control of Three Phase IM (Auto-transformer & VVVF)	
6	Direct Load Test on Single Phase Induction Motor	
7	Direct Loading Test on Three Phase Alternator	
8	Regulation of Alternator by Synchronous Impedance Method	
9	Plot 'V' Curves and Inverted 'V' Curves of Synchronous Motor	
10	Dismantling and Reassembling of Single Phase Motors (Fan/Mixer)	
11	Speed and Direction Control of Stepper Motor	
12	Speed and Direction Control of AC Servo Motor	
13	Speed and Direction Control of DC Servo Motor	

EXPERIMENT NO. 1

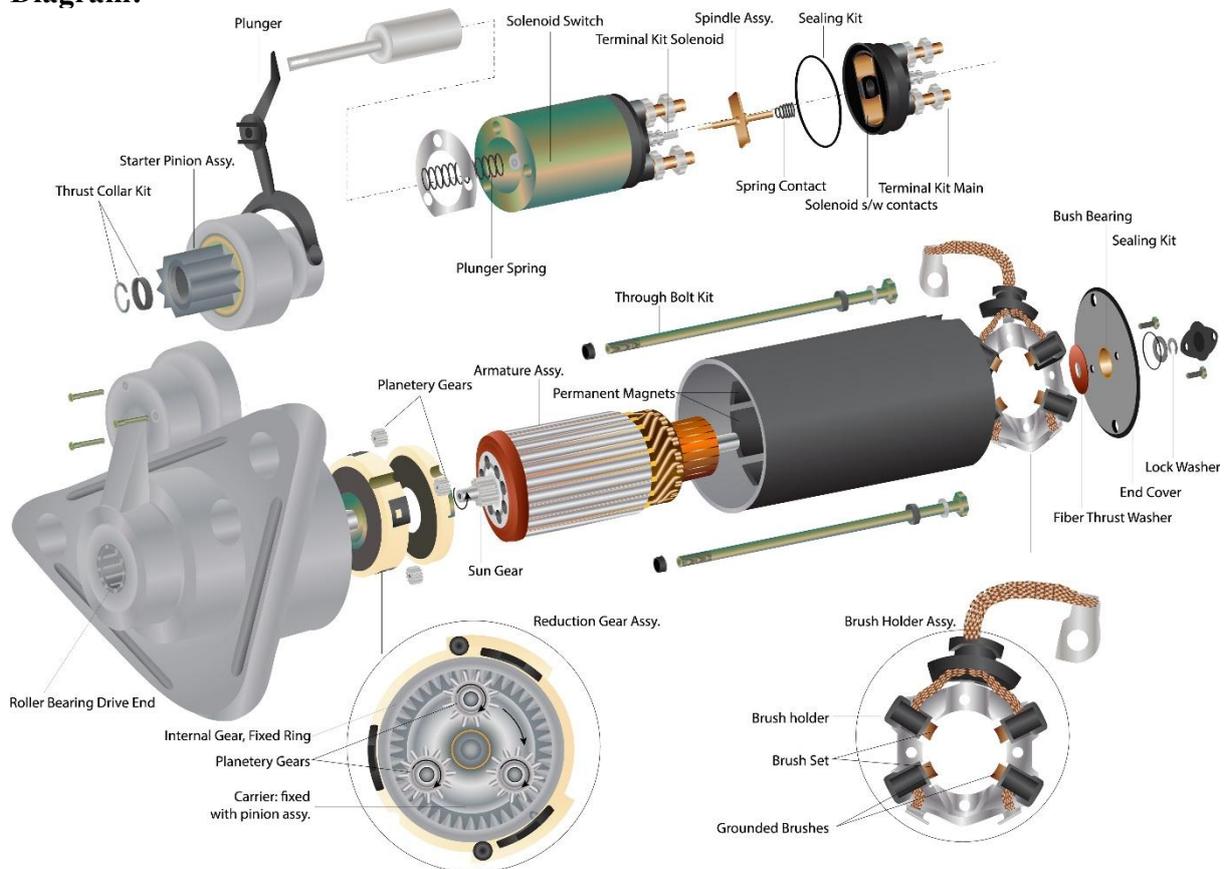
Title: Identification of Parts of Induction Motors

Aim: Identify the different parts (along with function and materials) for the given single-phase and three-phase induction motor.

Apparatus:

1. Cut-sectional model of 3-Phase Induction Motor.
2. Cut-sectional model of 1-Phase Induction Motor.

Diagram:



Exploded view of Starter Motor with Reduction Gears

Procedure:

1. Observe the external enclosure (Yoke/Frame) of the motor. Note its material.
2. Identify the Stator Core and Stator Windings inside the frame.
3. Identify the Rotor type (Squirrel Cage or Slip Ring).
4. Locate the cooling fan, bearings, and terminal box.
5. For the single-phase motor, identify the starting capacitor and centrifugal switch (if present).
6. Record the details in the table below.

Observation Table:

S.No.	Part Name	Material	Function
1	Stator Frame	Cast Iron/Steel	Supports the core and protects inner parts.
2	Stator Core	Silicon Steel	Houses stator winding; reduces iron losses.
3	Rotor Bars	Copper/Aluminum	Carries induced current to produce torque.
4	Shaft	Mild Steel	Transmits mechanical power.
5	End Rings	Copper/Aluminum	Short-circuits the rotor bars.

Result: The parts of single-phase and three-phase induction motors were identified.

EXPERIMENT NO. 2

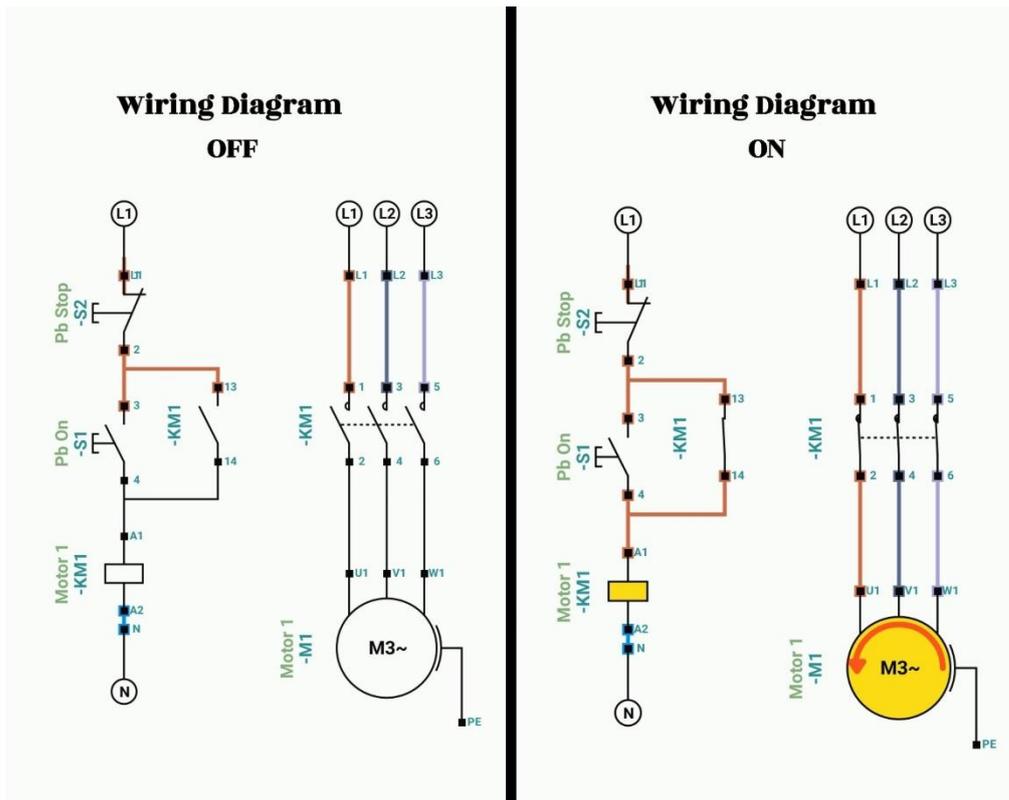
Title: Starting of Three-Phase Induction Motor

Aim: Connect and run the three-phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two).

Apparatus:

1. 3-Phase Induction Motor.
2. DOL Starter.
3. Star-Delta Starter.
4. Tachometer.

Circuit Diagram (DOL):



Circuit Diagram (Star-Delta):

Procedure:

1. **DOL Starter:** Connect the motor to the DOL starter. Switch on supply. Press 'Start'. Measure speed.
2. **Reverse Direction:** Stop the motor. Swap any two phase wires (e.g., R and Y). Restart and observe direction.
3. **Star-Delta Starter:** Connect motor terminals to the Star-Delta starter. Start in 'Star' position, then switch to 'Delta'. Measure speed.

Observation Table:

Starter Type	Direction of Rotation	Speed (RPM)
DOL	Clockwise	
DOL	Anti-Clockwise	
Star-Delta	Clockwise	

Result: The motor was started successfully and direction was reversed.

EXPERIMENT NO. 3

Title: Load Test on Three-Phase Induction Motor

Aim: Perform the direct load test on the three-phase squirrel cage induction motor and plot efficiency, power factor, and torque characteristics.

Apparatus:

1. 3-Phase Induction Motor with Brake Drum.
2. Two Wattmeters (W1, W2).
3. Voltmeter (0-600V), Ammeter (0-10A).

Circuit Diagram:

Procedure:

1. Connect the circuit as per the diagram with the brake drum belt loose.
2. Start the motor and record No-Load readings.
3. Gradually tighten the belt to increase load. Record V, I, W1, W2, Speed, and Spring Balance readings (S1, S2) at each step.
4. Calculate Torque, Output Power, and Efficiency.

Formulas:

- **Torque (T)** = $9.81 * (S1 \sim S2) * R$ (Nm)
- **Output Power** = $(2 * 3.14 * N * T) / 60$ (Watts)
- **Efficiency** = $(\text{Output Power} / (W1 + W2)) * 100$

Observation Table:

V (Volts)	I (Amps)	W1 (Watts)	W2 (Watts)	Speed (RPM)	S1 (kg)	S2 (kg)

Result: Load test performed and characteristics plotted.

EXPERIMENT NO. 4

Title: No-Load and Blocked-Rotor Tests

Aim: Conduct the No-load and Blocked-rotor tests on given 3-phase squirrel cage induction motor and determine the equivalent circuit parameters.

Apparatus:

1. 3-Phase Induction Motor.
2. 3-Phase Variac.
3. Wattmeters, Voltmeter, Ammeter.

Circuit Diagram:

Procedure:

1. **No-Load:** Apply rated voltage to the motor (no mechanical load). Record V_0 , I_0 , W_0 .
2. **Blocked-Rotor:** Lock the rotor. Apply reduced voltage until rated current flows. Record V_{sc} , I_{sc} , W_{sc} .

Observation Table:

A. No-Load Test: V_0 (Volts) I_0 (Amps) W_0 (Watts) :--- :--- :---
B. Blocked-Rotor Test: V_{sc} (Volts) I_{sc} (Amps) W_{sc} (Watts) :--- :--- :---

Result: Equivalent circuit parameters were determined.

EXPERIMENT NO. 5

Title: Speed Control of Three-Phase Induction Motor

Aim: Control the speed of the given three-phase squirrel cage/slip ring induction motor using: i) autotransformer, ii) VVVF.

Apparatus:

1. 3-Phase Induction Motor.
2. Auto-transformer & VFD Kit.

Diagrams:

Procedure:

1. **Auto-transformer:** Reduce stator voltage gradually. Observe speed drop.
2. **VVVF (VFD):** Change frequency (e.g., 50Hz, 40Hz, 30Hz) using the VFD. Observe speed change.

Observation Table:

Method	Voltage (V)	Frequency (Hz)	Speed (RPM)
Auto-Transformer	400	50	
Auto-Transformer	350	50	
VFD Control	400	50	
VFD Control	320	40	

Result: Speed control was demonstrated.

EXPERIMENT NO. 6

Title: Load Test on Single-Phase Induction Motor

Aim: Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single-phase induction motor.

Apparatus:

1. 1-Phase Induction Motor.
2. Brake Load setup.
3. Ammeter, Voltmeter, Wattmeter.

Circuit Diagram:

Procedure:

1. Start the motor at no load.
2. Apply load gradually. Record Voltage, Current, Power, and Speed.
3. Calculate % Regulation = $\frac{(\text{No Load Speed} - \text{Full Load Speed})}{\text{Full Load Speed}} \times 100$.

Observation Table:

V (Volts)	I (Amps)	Power (W)	Speed (N)	Torque (T)	Efficiency (%)

Result: Efficiency and regulation curves were plotted.

EXPERIMENT NO. 7

Title: Regulation of Alternator (Direct Loading)

Aim: Perform the direct loading test on the given three-phase alternator and determine the regulation and efficiency.

Apparatus:

1. Alternator Set.
2. Resistive Load Bank.

Circuit Diagram:

Procedure:

1. Run alternator at synchronous speed.
2. Adjust excitation to rated voltage.
3. Apply resistive load in steps. Record Terminal Voltage (V) and Current (I).

Observation Table:

S.No	Load Current (I)	Terminal Voltage (V)	Excitation (If)
1	0		Constant
2			Constant
3			Constant

Result: Regulation was determined by direct loading.

EXPERIMENT NO. 8

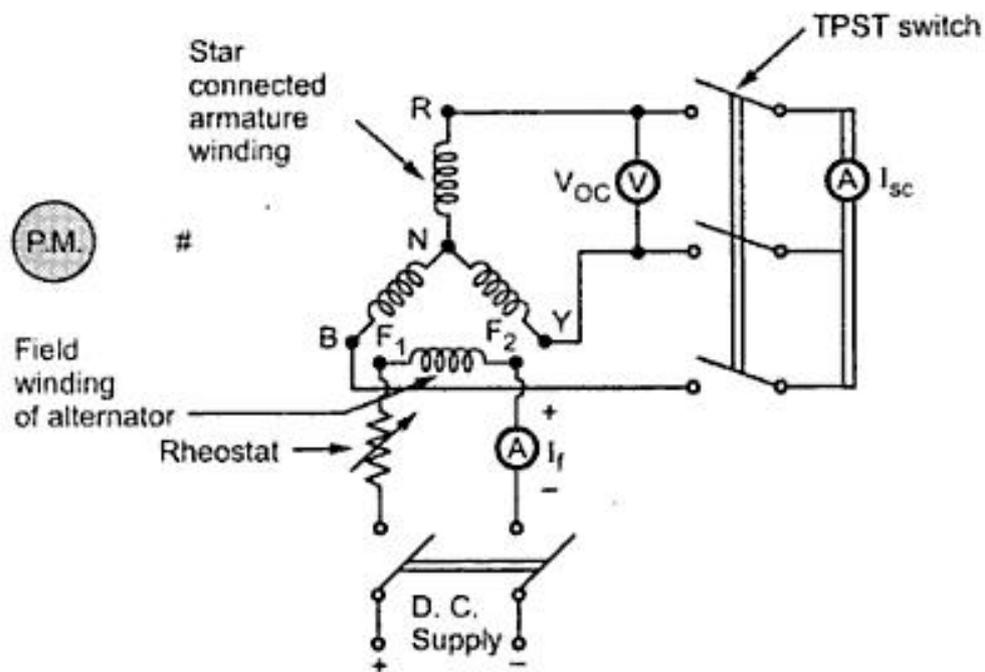
Title: Regulation of Alternator (Synchronous Impedance Method)

Aim: Determine the regulation and efficiency of the given three-phase alternator from OC and SC tests.

Apparatus:

1. Alternator Set.
2. Ammeters, Voltmeters, Rheostats.

Circuit Diagram:



Procedure:

1. **OC Test:** Open output terminals. Vary Field Current (I_f). Measure V_{OC} .
2. **SC Test:** Short output terminals. Vary Field Current (I_f). Measure I_{SC} .
3. **Calculation:** $Z_s = V_{OC} / I_{SC}$ (at same I_f).

Observation Table:

Field Current (I_f)	OC Voltage (V_{oc})	SC Current (I_{sc})

Result: Regulation calculated using Synchronous Impedance method.

EXPERIMENT NO. 9

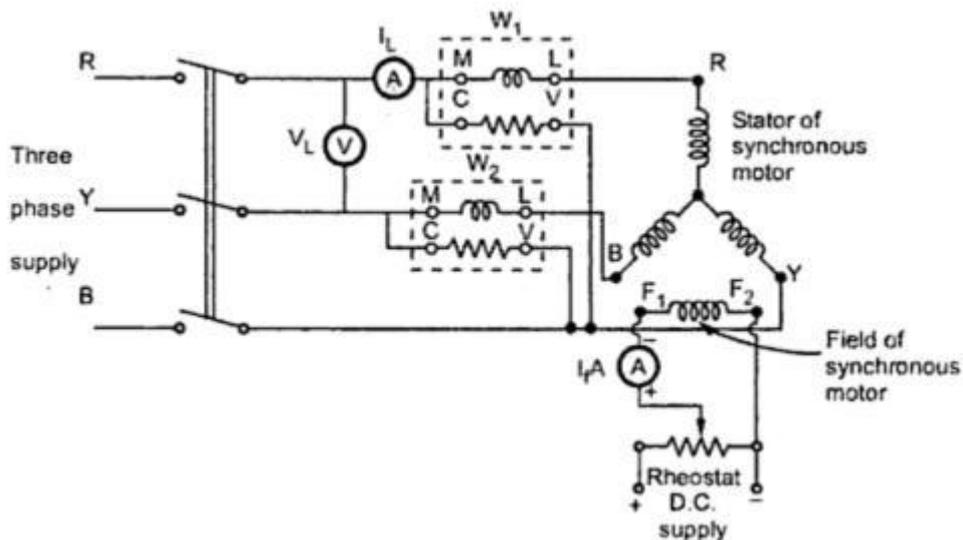
Title: 'V' Curves of Synchronous Motor

Aim: Conduct the test on load or no load to plot the 'V' curves and inverted 'V' curves of 3-phase synchronous motor.

Apparatus:

1. Synchronous Motor.
2. Rheostat, Ammeters.

Circuit Diagram:



Procedure:

1. Run motor at constant load.
2. Vary excitation current (I_f) from low to high.
3. Record Armature Current (I_a). Plot I_a vs I_f .

Observation Table:

Field Current (I_f)	Armature Current (I_a)	Power Factor

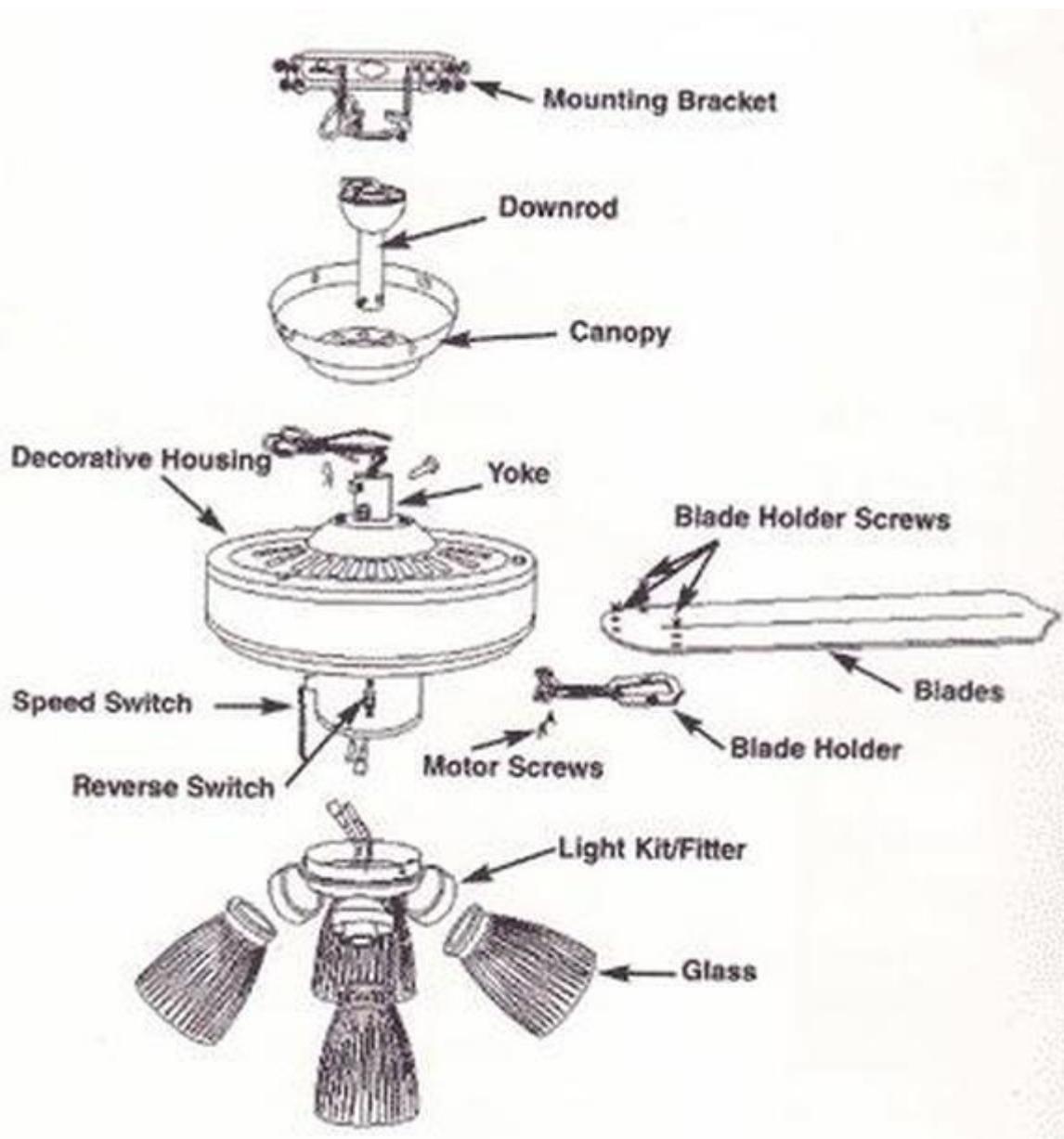
Result: 'V' curves plotted.

EXPERIMENT NO. 10

Title: Dismantling and Reassembling of FHP Motors

Aim: Dismantling and reassembling of single-phase motors used for ceiling fans, universal motor for mixer.

Diagrams:



Procedure:

1. **Ceiling Fan:** Open cover, remove capacitor, remove rotor. Inspect windings and bearings. Reassemble.
2. **Mixer:** Open casing, check carbon brushes, remove armature, clean commutator. Reassemble.

Observation Table:

Motor Type	Parts Identified	Condition (Good/Worn)
Ceiling Fan		
Mixer		

Result: Dismantling and reassembling completed.

EXPERIMENT NO. 11

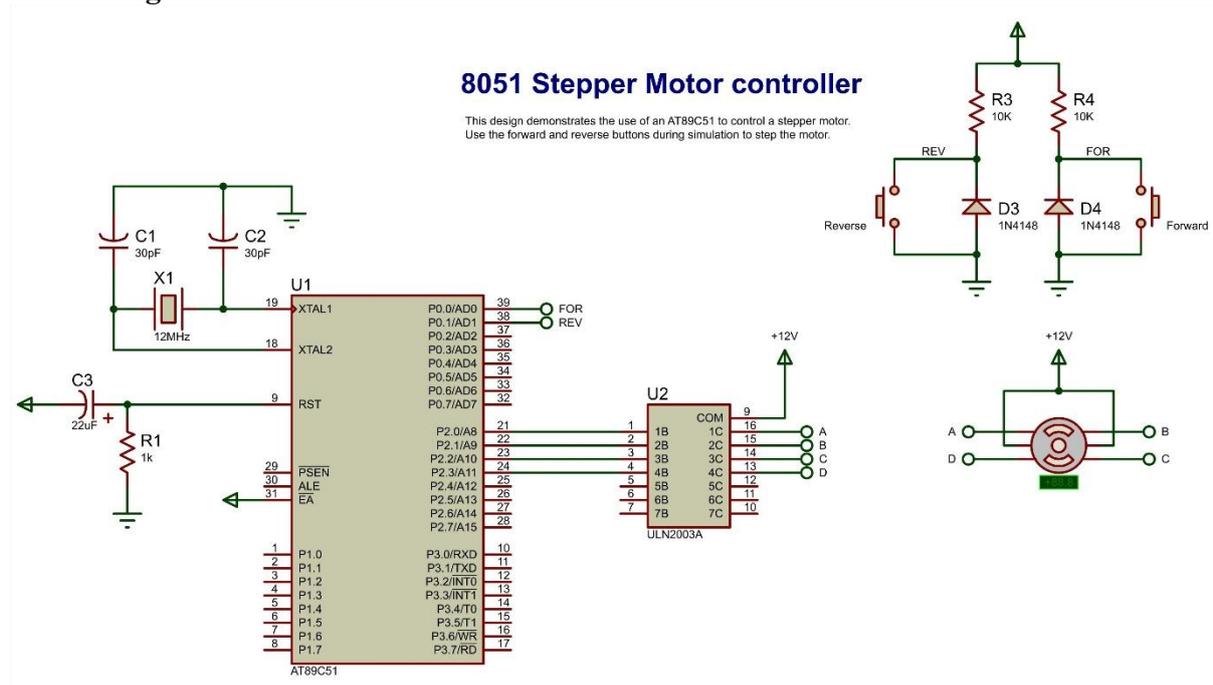
Title: Control of Stepper Motor

Aim: Control the speed and reverse the direction of stepper motor.

Apparatus:

1. Stepper Motor Kit.

Block Diagram:



Procedure:

1. Connect motor to driver.
2. Input step angle/delay to change speed.
3. Change sequence to reverse direction.

Observation Table:

Step Angle	Direction	Observation (Speed/Motion)
	Clockwise	
	Anti-Clockwise	

Result: Stepper motor controlled.

EXPERIMENT NO. 12

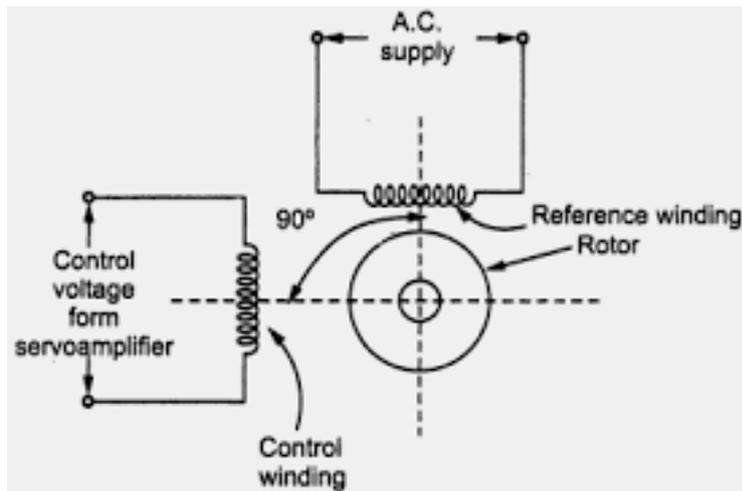
Title: Control of AC Servo Motor

Aim: Control the speed and reverse the direction of the AC servo motor.

Apparatus:

1. AC Servo Kit.

Block Diagram:



Procedure:

1. Apply control voltage.
2. Vary voltage magnitude to change speed.
3. Change polarity to reverse direction.

Observation Table:

Control Voltage (V)	Speed (RPM)	Direction

Result: AC Servo motor controlled.

EXPERIMENT NO. 13

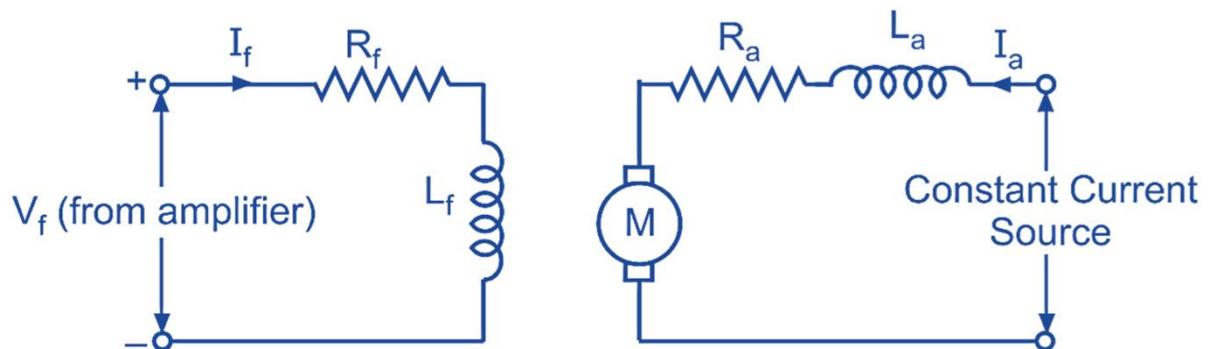
Title: Control of DC Servo Motor

Aim: Control the speed and reverse the direction of the DC servo motor.

Apparatus:

1. DC Servo Kit.

Block Diagram:



Procedure:

1. Connect kit.
2. Vary reference voltage for speed control.
3. Use direction switch for reversal.

Observation Table:

Reference Voltage (V)	Speed (RPM)	Direction

Result: DC Servo motor controlled.