1 Experiment No. 1

2 Experiment Title

Introduction to different DC and AC Machines and General discussion on Safety and Precautions

3 Objective

The objectives of this lab are as follows:

- To examine and document the specifications of various electrical equipment and training modules.
- To identify the functions and operational parameters of the provided devices.
- To ensure proper handling and safety measures while working with electrical components.
- To analyze the role of each module in electrical circuit training and practical applications.
- To develop an understanding of measurement techniques and data recording for future experiments.

4 Theory

A machine is a device that uses energy to perform a specific task. It can be mechanical, electrical, or a combination of both. Machines typically convert one form of energy into another to accomplish work.In the context of your lab report, DC and AC machines refer to electrical machines that either convert electrical energy into mechanical energy (motors) or mechanical energy into electrical energy (generators). Transformers, which modify voltage levels, are also considered AC machines.

5 Types of DC and AC Machines

5.1 DC Machines

DC machines are commonly used in applications requiring variable speed control and high starting torque. They are classified into:

1. **DC Motors**: Convert electrical energy into mechanical energy.
2. **DC Generators**: Convert mechanical energy into electrical energy.

Based on excitation, DC machines are further classified as:

1. Separately excited DC machines
2. Shunt-wound DC machines
3. Series-wound DC machines
4. Compound-wound DC machines

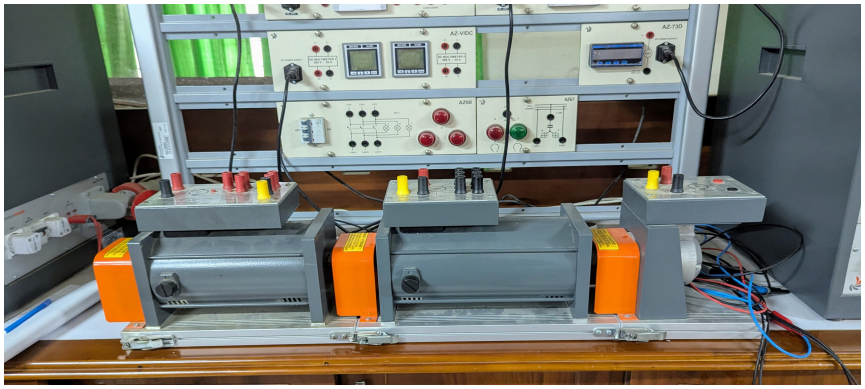


Figure 1: Complete Experimental Setup

5.2 AC Machines

AC machines are widely used due to their efficiency and robustness. They are classified into:

1. **Induction Machines**: Work on the principle of electromagnetic induction.
2. **Synchronous Machines**: Operate at a constant speed determined by the supply frequency.

6 Description of Machines

6.1 DC Motor and Generator

A universal motor is a type of electric motor that can operate on both AC and DC power supplies. It is commonly found in household appliances like mixers and drills.

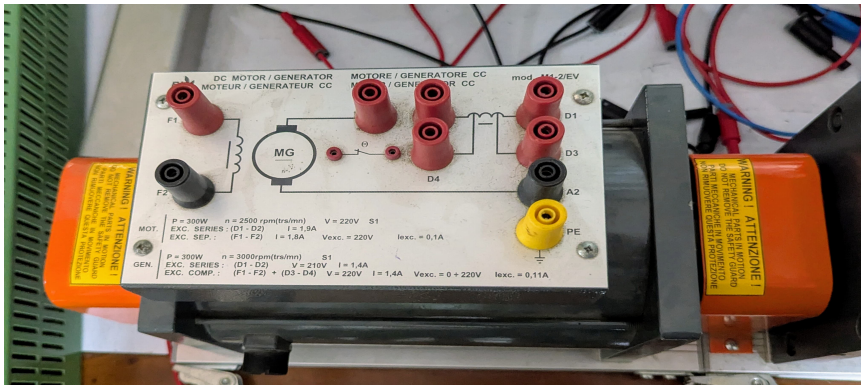


Figure 2: DC Motor and Generator

6.1.1 DC Motor Specifications

Table 1: DC Motor Specifications

Specification	Value
Power Rating	300 W
Voltage Rating [EXC.SERIES & EXC. SEP]	220 V
Current Rating [EXC SERIES]	1.9 A
Current Rating [EXC SEP]	1.8 A
Vexc	220 V
Iexc	0.1 A
Speed	2500 RPM

6.1.2 DC Generator Specifications

Table 2: DC Generator

Specification	Value
Power Rating	300 W
Voltage Rating [EXC.SERIES]	210 V
Voltage Rating [EXC. COMP]	220 V
Current Rating [EXC SERIES & EXC COMP]	1.4 A
Vexc	0-220 V
Iexc	0.11 A
Speed	3000 RPM

6.2 Three-Phase Asynchronous Motor

A three-phase asynchronous motor, also known as an induction motor, operates on the principle of electromagnetic induction. It is widely used in industrial applications due to its robustness and self-starting capability.

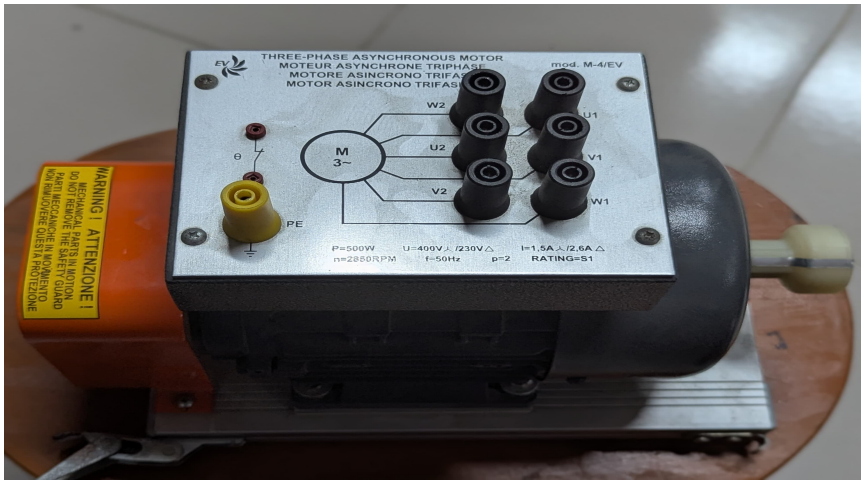


Figure 3: Three-Phase Asynchronous Motor

6.2.1 Specifications of Three-Phase Asynchronous Motor

Table 3: Three-Phase Asynchronous Motor Specifications

Type	Power (W)	Speed (rpm)	Voltage (V)	Current (A)	Frequency (Hz)	Poles
Star Connection	500	2850	400	1.5	50	2
Delta Connection	500	2850	230	2.6	50	2

6.3 Three-Phase Synchronous Motor

A three-phase synchronous motor runs at a constant speed determined by the supply frequency. It requires external excitation and is commonly used in applications requiring precise speed control.

Figure 4: Power Supply Specifications

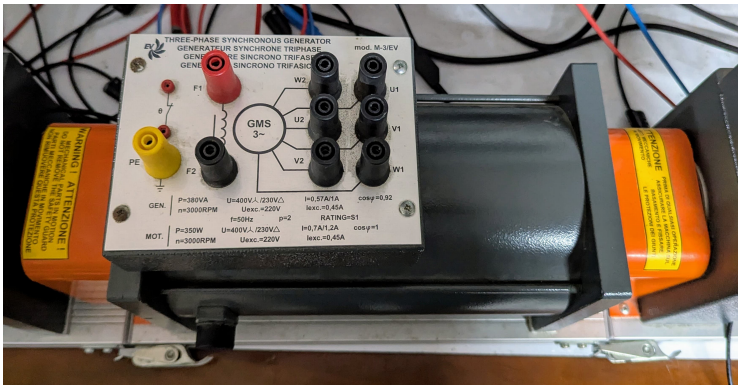


Figure 5: Three-Phase Synchronous Motor

6.3.1 Specifications of Three-Phase Synchronous Motor

Table 4: Three-Phase Synchronous Motor Specifications

Type	Power (W)	Speed (rpm)	Voltage (V)	Current (A)	cos ϕ	Exc. Volt. (V)	Exc. Curr. (A)
Star	350	3000	400	0.7	1	220	0.45
Delta	350	3000	230	1.2	1	220	0.45

6.4 Universal Motor

A universal motor is a type of electric motor that can operate on both AC and DC power supplies. It is commonly found in household appliances like mixers and drills.

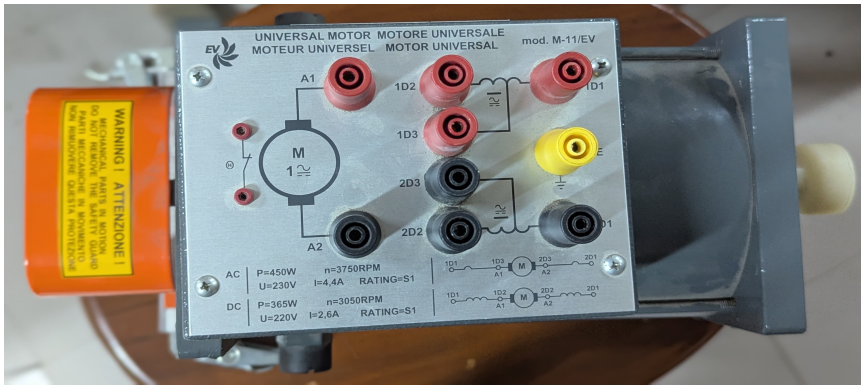


Figure 6: Universal Motor

6.4.1 Specifications of Universal Motor

Table 5: Specifications of Universal Motor

Type	Power (W)	Speed (rpm)	Voltage (V)	Current (A)
AC Operation	450	3750	230	4.4
DC Operation	365	3050	220	2.6

6.5 Tachogenerator

A tachogenerator is a device used to measure the rotational speed of a shaft. It converts mechanical motion into a proportional electrical signal.

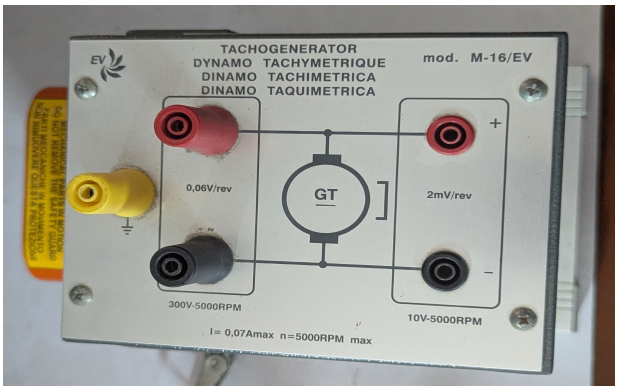


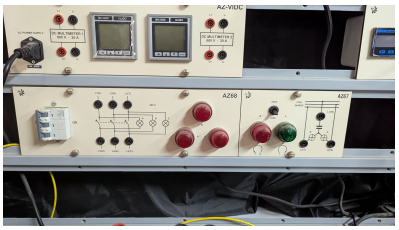
Figure 7: Tachogenerator

Table 6: Universal Motor Specifications

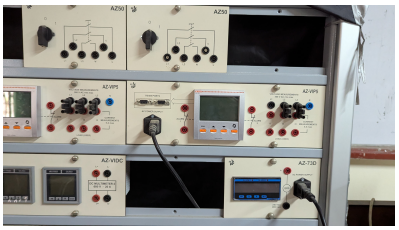
Voltage Constant	Voltage (V)	Speed (rpm)	Current (A)
0.06 V/rev	300	5000	0.07
2 mV/rev	10	5000	0.07

6.6 AC-DC Multimeter

An AC-DC multimeter is an instrument used to measure voltage, current, and resistance in both AC and DC circuits.



(a)



(b)

(c)

Table 7: AC-DC Multimeter Specifications

Feature	Specification	Notes
Modules	AZ50 (x2), AZ-VIPS (x2), AZ-VIDC, AZ-73D, AZ68, AZ67	Modular components
AZ50 Function	Basic Circuit Demo	
AZ-VIPS Function	Digital Power Analysis	Voltage & Current Measurement
AZ-VIPS Voltage	500V AC RMS Max	
AZ-VIPS Current	5A Max	
AZ-VIPS Comm.	RS485 Ports	
AZ-VIDC Function	DC Measurement	Two DC multimeters
AZ-VIDC Meters	QUBO (x2)	Digital meters
AZ-VIDC Range	600V, 20A (DC)	For both multimeters
AZ-73D Function	Digital Measurement	
AZ67 Function	Connection/Switching	
AZ67 Voltage	36-400V (AC)	
Connectivity	Banana Plugs	
Power	AC Supply	Multiple Modules
Construction	Rack Mounted Panels	

6.7 DC Current Stator

A DC current stator is a stationary part of a DC machine that produces a magnetic field necessary for the operation of the motor or generator.

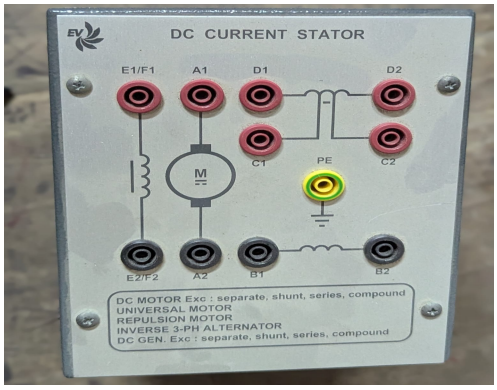


Figure 9: DC Current Stator

Table 8: Specifications of current stator

Feature	Specification
Type	DC Current Stator Training Module
Manufacturer	EV
Function	DC Motor/Generator Stator Connection Experiments
Motor Types	DC (Separate, Shunt, Series, Compound), Universal, Repulsion
Generator Types	DC (Separate, Shunt, Series, Compound), Inverse 3-Phase Alternator
Connections	E1/F1, E2/F2, A1, A2, D1, D2, C1, C2, B1, B2, M, PE
Indicator	Ground (PE) LED

Table 9: DC Current Stator Training Module Specifications

6.8 Resistors

Resistors are passive electrical components that limit the flow of current in a circuit, helping in voltage regulation and circuit protection.

(a) 5000Ω

(b) 3×50Ω

(c) 3×50Ω

6.8.1 Specifications of Resistors

Table 10: Resistors Specifications

Resistance (Ω)	Power (W)	Current (A) Max. Voltage (V)	Phase	IP
50	500	3.16	1	20
200	500	1.58	1	20
5000	500	0.31	1	20
3 × 50	3 × 500	3 × 3.16	3	20

6.9 Power Supply

A 230V DC supply provides a stable direct current voltage for operating electrical machines and circuits requiring high voltage DC power.

Figure 11: LCD/LED TV Trainer

6.9.1 Specifications of Power Supply

Table 11: Power Supply Specifications

Specification	**Details**
Manufacturer	ElettronicaVeneta
Model	AV-1/EV
Input	400V AC, 10A (Three-Phase)
Variable AC Output	0-430V AC (Three-Phase)
Variable DC Output	0-300V DC, 4A
Fixed DC Outputs	6V, 12V, 24V; 5V, 12V(2A); 220V(3A)
Emergency Stop	Yes

6.10 3-Point Starter

A 3-point starter is a protective device used to limit the inrush current when starting a DC motor, ensuring safe and efficient operation.

(a) 3-Point Starter

(b) Motor-Starter Circuit Connector

7 Safety and Precautions

Handling electrical machines requires adherence to safety guidelines to prevent electrical hazards, injuries, and equipment damage. Some key precautions include:

1. Always wear insulating gloves and shoes while working with electrical machines.
2. Ensure proper grounding and insulation to avoid electrical shocks.
3. Avoid touching live wires and rotating parts while machines are operational.
4. Regularly inspect machines for loose connections and overheating.
5. Follow manufacturer guidelines and safety procedures during operation and maintenance.

8 Discussion

During the experiment, the specifications and photographs of various electrical components and training modules were carefully noted. The equipment was examined to understand its operational parameters, including voltage, current, and power ratings. Each component's function was identified, and its role in the training system was documented. Safety precautions were strictly followed throughout the experiment. Proper handling of high-voltage equipment was ensured, and insulated tools were used to prevent accidental shocks. Additionally, connections were double-checked before powering the system to avoid short circuits or incorrect wiring. Personal protective equipment was worn, and the workspace was kept organized to minimize hazards. The data collected provided insight into the technical specifications of the equipment, which will be useful for future experiments and practical applications.