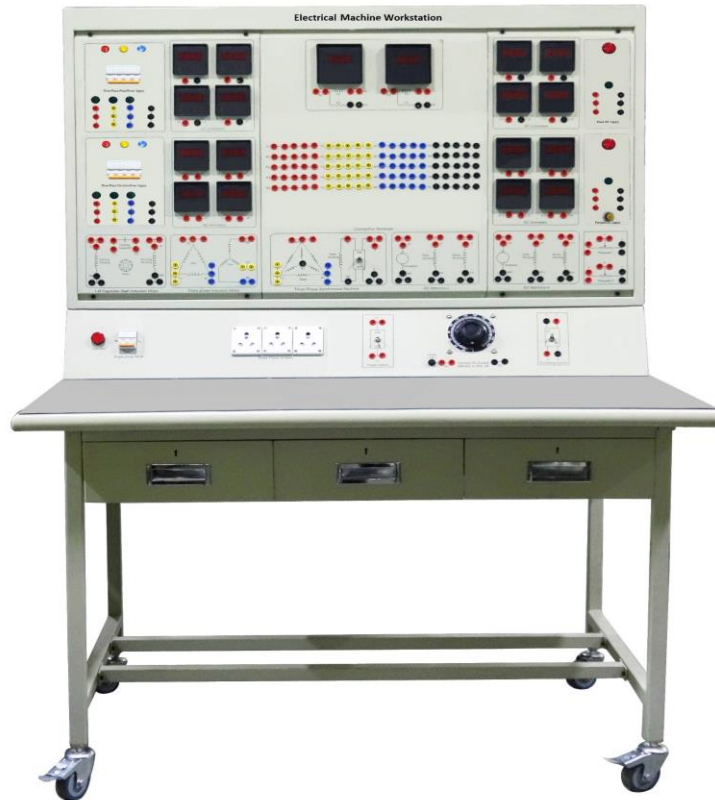


Electrical Machine WorkBench



Electrical Workbench are very much useful for teaching of Electrical Machines fundamentals. It is a modular design which provides flexibility for the students to perform experiments over AC and DC Machines using inbuilt Power Supply, Meters, single and three phase fixed and variable power supplies, protection devices such as Fuses, MCB's, Supply Indicators, etc. Electrical Machine workbench allows students to understand the operational characteristics and working of AC and DC Machines.

Note: All AC & DC Machines along with supporting accessories are available optionally.

An integrated workbench consisting of instrument panel and working table suitable for students to learn and perform various experiments of electronics lab should internally electrically connected and should be fitted in the panel such that only front panel and necessary interfaces are easily accessible to use.

Structure of workbench made up of 1.5 mm thick CRC powder coated pipes with top made up of good quality 19 mm thick plywood and covered with 1.8 mm off white color mica laminates.

The bench working area should be covered by 2 mm thick antistatic mat which help students to controls static discharge as static cause interference or damage to students, equipment and circuitry.

The basic structure should be made of maximum 38 x 38 x 1.5 mm CRC powder coated pipes for sturdiness.

The overall dimensions of Workbench should be not less than W = 1500 mm; D = 750 mm; H = 1200 mm

MS drawers 03 numbers W = 275 mm; D = 375 mm; H = 100 mm and thickness 1.2mm with handle & separate lock on each drawer. Double Pole MCB (32A, Havells/Siemens) will be provided for safety of Workbench

Control panel shall be provided CRCA powder coated MS Box with screen printed mimic diagram of major components. All input and output shall be terminated in safety 4mm shrouded connector and safety 4mm banana cable shall be provided for experiments.

Features:

1. Wheel (with locking mechanism) is provided at legs of workbench so that it can be easily moved.
2. MCB is provided with AC supply for safety purpose
3. Drawers For keeping manuals, connecting Wires, tools, meters, documents etc. in lock & Key.
4. Sufficient workspace to work.
5. Power Extension board in built
6. Cooling fan for heat dissipation
7. Antistatic mat

8. Inbuilt Load Section (Rheostat)
9. Inbuilt AC and DC Power Supply (Single and Three phase both) required to drive the Machines.
10. Protection devices Such as Fuse, MCB etc.
11. Multiple Buses for interconnections of Motors / Generators with onboard components and measuring devices
12. Compatible for Machines up to 2HP.
13. Diagrammatic representation of AC and DC Machines for better understanding.
14. Rust Free Powder Coating Paint.
15. Standard BS-10 terminals, patch cords for safety purpose.
16. High Quality Digital Tachometer for RPM Measurement
17. Motors provided with standard Mechanical Loading Arrangement Facility.
18. Motors with 'aluminum' casted Brake-Drum/Pulley with heat suppression facility.
19. Machines with Class 'B' Insulation.
20. Flexible shaft coupling arrangement (Lovejoy) for Motor Generator (MG) Sets.
21. 1.5 mm x 3mm Heavy Duty Base/Channel with facility to concrete machine
22. Generator with Electrical Loading Arrangement Facility.
23. Durable good quality spring balance.
24. Designed by considering all the safety measures.
25. Operating Manuals are designed so beautifully that makes the workbench more User friendly.
26. Built-in DC Excitation Unit for field winding of three phase synchronous motor/generator
27. Built-in Single Phase Transformer
28. Three Phase Supply indication lamps
29. Machine winding consist of copper for long term service
30. Earthing screw provided at the back side of the control set-up
31. Product should be provided with protection fuses, colored patch cords, single phase\ three phase cords, learning manual CD having theory operating procedure with connecting diagram, FAQ, Glossary, etc

Note: All AC & DC Machines along with supporting accessories are available optionally.

Technical Specifications

Mains Supply : 415VAC \pm 10%, 50Hz with VSS to monitor Voltage

Single Phase transformer

Primary Voltage : 0-125V, 0-125V \pm 10%, 50Hz

Secondary Voltage : 0-125V, 0-125V \pm 10%, 50Hz

Current Capacity : 2A

Winding : Copper

Three Phase transformer

Primary Voltage : 415VAC \pm 10%, 50Hz

Secondary Voltage : 230VAC \pm 10%, 50Hz

Current Capacity : 2A

Winding : Copper

DC Power Supply

Output Voltage : 0 to 220VDC \pm 10%

Current Capacity : 15A

DC Excitation Unit

Output Voltage : 0 to 300VDC \pm 10%

Current Capacity : 2A

Instrumentation power supply : 24VDC, 10Amp (for BLDC Motor)

Measuring Instruments

AC Digital Ammeter (2Nos.)

Range : 10A

Topology : Controller Based

AC Digital Voltmeter (2Nos.)

Range : 450V

Topology : Controller Based

DC Digital Ammeter (2Nos.)

Range : 20A

Topology : Controller Based

DC Digital Voltmeter (2Nos.)

Range : 300V

Topology : Controller Based

Single Phase Digital Wattmeter (2Nos.)

Range	: 4kW
Topology	: Controller Based
Digital Handheld Tachometer	
Range	: 19,999 rpm
Type	: Contact / Non-contact
Protective Devices	
Three Phase MCB (TPN)	: 1 No.
Single Phase MCB (DP)	: 2 Nos.
Glass Fuses	: 9 Nos.
Grounding Nut	: Available at the rear side of the panel
Interconnections	: 4mm BS-10 Safety Terminals

Technical Specification of Machines compatible with above workbench (Optional)

AC Motor

Type : **1- \emptyset Capacitor Start Induction Motor (PS-CSIR05 to PS-CSIR20)**

Power Rating	: 0.5HP to 2HP
Voltage Rating	: 220V AC \pm 5%, 50Hz
Rated Speed	: 1440RPM \pm 7.5%
Insulation	: Class 'B'

Loading arrangement	: Mechanical
Spring Balance	: 2 Nos. (Tubular Type)
Brake Drum/Pulley	: Aluminum Casted with heat suppression facility
Machine Base	: "C" Channel
Protection	: Fuses (mounted at the terminal box of the Machines)

Type : **3- \emptyset Squirrel Cage Induction Motor (PS-SQM10 to PS-SQM30)**

Power Rating	: 0.5HP to 3HP
Voltage Rating	: 415V AC \pm 5%, 50Hz
Rated Speed	: 1440RPM \pm 7.5%
Insulation	: Class 'B'

Loading arrangement	: Mechanical
Spring Balance	: 2 Nos. (Tubular Type)
Brake Drum/Pulley	: Aluminum Casted with heat suppression Facility
Machine Base	: "C" Channel
Protection	: Fuses (mounted at the terminal box of the Machines)

Type : **3- \emptyset Slip Ring Induction Motor (PS-SRM30)**

Power Rating	: 3HP
Voltage Rating	: 415V AC \pm 5%, 50Hz
Rated Speed	: 1440RPM \pm 7.5%
Insulation	: Class 'B'

Loading arrangement	: Mechanical
Spring Balance	: 2 Nos. (Tubular Type)
Brake Drum/Pulley	: Aluminum Casted with heat suppression Facility
Machine Base	: "C" Channel
Protection	: Fuses (mounted at the terminal box of the Machines)

Type : **3- \emptyset AC Three Phase Synchronous Motor (PS-TPM30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

Three Phase Synchronous Machine (act as Motor)

Type	: Salient Type
Power Rating	: 3 HP
Voltage Rating	: 415V AC \pm 10%, 50Hz
Configuration	: Delta Connected
Rated Speed	: 1500RPM \pm 5%
Insulation	: Class 'B'
Excitation Voltage	: 180Vdc \pm 10%

DC Machine (act as Generator)

Type	: Shunt
Power Rating	: 2 HP
Rated Speed	: 1500RPM \pm 7.5%
Insulation	: Class 'B'
Loading Arrangement	: Electrical
Type of Coupling	: Flexible "Lovejoy" Coupling

Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)
Type : **3-Ø AC Three Phase Synchronous Machine (PS- TP30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (act as Motor)

Type : Shunt
Power Rating : 2 HP
Rated Speed : 1500RPM ± 7.5%
Insulation : Class 'B'
Loading Arrangement : Electrical
Type of Coupling : Flexible "Lovejoy" Coupling
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Three Phase Synchronous Machine (act as Motor)

Type : Salient Type
Power Rating : 3 HP
Voltage Rating : 415V AC ± 10%, 50Hz
Configuration : Star Connected
Rated Speed : 1500RPM ± 5%
Insulation : Class 'B'
Excitation Voltage : 180Vdc ± 10%

AC Generator

Type : **AC Three Phase Synchronous Generator (PS- TPG30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (act as Motor)

Type : Shunt
Power Rating : 2 HP
Rated Speed : 1500RPM ± 7.5%
Insulation : Class 'B'
Loading Arrangement : Electrical
Type of Coupling : Flexible "Lovejoy" Coupling
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Three Phase Synchronous Machine (act as Generator)

Type : Salient Type
Power Rating : 3 HP
Voltage Rating : 415V AC ± 10%, 50Hz
Configuration : Delta Connected
Rated Speed : 1500RPM ± 5%
Insulation : Class 'B'
Excitation Voltage : 180Vdc ± 10%

DC Motors

Type : **BLDC Motor (PS-BLDC05)**

Rating : 200W
Voltage Rating : 24VDC
Current : 8A
Speed : 2500 rpm ±10%
Loading arrangement : Mechanical
Brake Drum/Pulley : Aluminum Casted

Type : **Universal Motor (PS-UM05 to PS-UM30)**

Power Rating : 0.5HP to 3HP
Voltage Rating : 220V AC & DC ± 5%
Rated Speed : 1500RPM ± 7.5%
Insulation : Class 'B'
Loading arrangement : Mechanical
Spring Balance : 2Nos.(Tubular Type)
Brake Drum/Pulley : Aluminum Casted with heat suppression facility
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Type : **PMDC Motor (PS-PMDC05 to PS-PMDC30)**
Power Rating : 0.5HP to 3HP
Voltage Rating : 220V DC \pm 5%
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'
Loading arrangement : Mechanical
Spring Balance : 2Nos. (Tubular Type)
Brake Drum/Pulley : Aluminum Casted with heat suppression facility
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Type : **Shunt Motor (PS-SHM05 to PS-SHM30)**
Power Rating : 0.5HP to 3HP
Voltage Rating : 220V DC \pm 5%
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'
Loading arrangement : Mechanical
Spring Balance : 2Nos.(Tubular Type)
Brake Drum/Pulley : Aluminum Casted with heat suppression facility
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Type : **Series Motor (PS-SM05 to PS-SM30)**
Power Rating : 0.5HP to 3HP
Voltage Rating : 220V DC \pm 5%
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'
Loading arrangement : Mechanical
Spring Balance : 2Nos.(Tubular Type)
Brake Drum/Pulley : Aluminum Casted with heat suppression facility
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

Type : **Compound Motor (PS-CM05 to PS-CM30)**
Power Rating : 0.5HP to 3HP
Voltage Rating : 220V DC \pm 5%
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'
Loading arrangement : Mechanical
Spring Balance : 2Nos.(Tubular Type)
Brake Drum/Pulley : Aluminum Casted with heat suppression facility
Machine Base : "C" Channel
Protection : Fuses (mounted at the terminal box of the Machines)

DC Generators

Type : **DC Shunt Motor Shunt Generator (PS-SHG05 to PS-SHG30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (acts as prime mover)

Type : Shunt
Voltage Rating : 220V DC \pm 5%
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'

DC Machine (acts as generator)

Type : Shunt
Power Rating : 0.5HP to 3HP
Rated Speed : 1500RPM \pm 7.5%
Insulation : Class 'B'
Shaft extension : Single Sided

Loading Arrangement : Electrical
Type of Coupling : Flexible "Lovejoy" Coupling
Machine Base : "C" Channel

Protection : Fuses (mounted at the terminal box of the Machines)

Type : **DC Shunt Motor Series Generator (PS-SG05 to PS-SG30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (acts as prime mover)

Type : Shunt
 Voltage Rating : 220V DC \pm 5%
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'

DC Machine (acts as generator)

Type : Series
 Power Rating : 0.5HP to 3HP
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'
 Shaft extension : Single Sided

Loading Arrangement

: Electrical

Type of Coupling

: Flexible "Lovejoy" Coupling

Machine Base

: "C" Channel

Protection

: Fuses (mounted at the terminal box of the Machines)

Type : **DC Shunt Motor Compound Generator (PS-CG05 to PS-CG30)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (acts as prime mover)

Type : Shunt
 Voltage Rating : 220V DC \pm 5%
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'

DC Machine (acts as generator)

Type : Compound
 Power Rating : 0.5HP to 3HP
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'
 Shaft extension : Single Sided

Loading Arrangement

: Electrical

Type of Coupling

: Flexible "Lovejoy" Coupling

Machine Base

: "C" Channel

Protection

: Fuses (mounted at the terminal box of the Machines)

For Field Test of DC Series Machine

Type : **DC Series Motor Series Generator (PS-SSG05 to PS-SSG10)**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (acts as prime mover)

Type : Series
 Voltage Rating : 220V DC \pm 5%
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'

DC Machine (acts as generator)

Type : Series
 Power Rating : 0.5HP to 1HP
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'
 Shaft extension : Single Sided

Loading Arrangement

: Electrical

Type of Coupling

: Flexible "Lovejoy" Coupling

Machine Base

: "C" Channel

Protection

: Fuses (mounted at the terminal box of the Machines)

For Hopkinson Test of DC Shunt Machine

Type : **Two identical DC Shunt Motor coupled (PS-HT05 to PS-HT10)**

Both the Machines are Identical and flexibly coupled to Mounted on a Single 'C' Channel Base

DC Machine

Type : Shunt (2Nos.)
 Power Rating : 0.5HP to 1HP
 Rated Speed : 1500RPM \pm 7.5%
 Insulation : Class 'B'
 Shaft extension : Single Sided

Loading Arrangement	: Electrical
Type of Coupling	: Flexible “Lovejoy” Coupling
Machine Base	: “C” Channel
Protection	: Fuses (mounted at the terminal box of the Machines)

For Ward Leonard Test of DC Machine

Type : **3- ϕ Induction Motor coupled with DC Shunt Generator (PS-WL10 to PS- WL30)**

Both the machines are flexibly coupled and mounted on a “C” Channel base

AC Machine (Act as prime mover)

Type	: Three Phase squirrel cage induction motor
Voltage Rating	: 415VAC \pm 10%, 50Hz
Speed	: 1440 rpm \pm 10%
Insulation	: Class ‘F’
Winding	: Copper
Loading arrangement	: Electrical

DC Machine (Act as generator)

Type	: Shunt
Power Rating	: 1 HP to 3HP
Generated Voltage Rating	: 220VDC \pm 10% at load
Speed	: 1500 rpm \pm 10%
Insulation	: Class ‘F’
Winding	: Copper
Type of Coupling	: Flexible “Lovejoy” Coupling
Machine Base	: “C” Channel

DC Machine (Act as motor which speed have to be controlled using above MG Set)

Type	: Shunt
Power Rating	: ½ HP
Voltage Rating	: 220VDC \pm 10%
Speed	: 1500 rpm \pm 7.5%
Insulation	: Class ‘F’
Enclosure	: SPDP

Scope of Learning based on Machines opt by Customer

Single Phase Capacitor Start Induction Run Motor (PS-CSIR05 to PS-CSIR20)

- Operational working fundamentals
- Importance of running winding
- Running and Reversing phenomenon
- No-Load Test and correspondingly calculate pf at no load condition, equivalent parameters for equivalent circuit
- Block-Rotor Test and correspondingly calculate pf at locked rotor condition, equivalent parameters for equivalent circuit
- Load Test and correspondingly can draw a graph among voltage, current, torque and speed.
- Calculate Slip test using standard formulas

Three Phase Squirrel Cage Induction Motor (PS-SQM10 to PS- SQM30)

- Operational working fundamentals
- Importance of running winding
- Running and Reversing phenomenon
- No-Load Test and correspondingly calculate pf at no load condition, equivalent parameters for equivalent circuit
- Block-Rotor Test and correspondingly calculate pf at locked rotor condition, equivalent parameters for equivalent circuit
- Load Test and correspondingly can draw a graph among voltage, current, torque and speed.
- Calculate Slip test using standard formulas

Three Phase Slip Ring (Wound Type) Induction Motor (PS- SRM30)

- Operational working fundamentals
- Importance of running winding
- Running and Reversing phenomenon
- No-Load Test and correspondingly calculate pf at no load condition, equivalent parameters for equivalent circuit
- Block-Rotor Test and correspondingly calculate pf at locked rotor condition, equivalent parameters for equivalent circuit
- Load Test and correspondingly can draw a graph among voltage, current, torque and speed.
- Calculate Slip test using standard formulas

Three Phase Salient Pole Synchronous Motor (PS- TPM30)

- Operational Working Principle and its fundamentals
- V curve of Three Phase Synchronous Motor from no load to load condition
- Inverse V curve of the Three Phase Synchronous Motor from no load to load condition

Three Phase Salient Pole Synchronous Machine (PS- TP30)

- Operational Working Principle and its fundamentals
- Measurement of Direct Axis Sub-Transient Reactance (X_d'')
- Measurement of Quadrature Axis Sub-Transient Reactance (X_q'')
- Measurement of Direct Axis (X_d) Reactance by Slip Test
- Measurement of Quadrature Axis (X_q) Reactance by Slip Test
- Measurement of Positive Sequence Impedance
- Measurement of Negative Sequence Impedance
- Measurement of Zero Sequence Impedance

Three Phase Salient Pole Synchronous Generator (PS- TPG30)

- Operational Working Principle and its fundamentals
- Short circuit characteristics (SCC)
- Open Circuit Characteristics (OCC)
- Short Circuit Ratio (SSC)
- Voltage regulation of Three Phase Synchronous Generator using EMF Method
- Voltage regulation of Three Phase Synchronous Generator by Direct Loading

Single Phase Transformer (Built-in with Workbench or externally connected)

- Study of Isolation Transformer
- Study of Step-up Transformer
- Study of Step-down Transformer
- Study of Additive Polarity Test in a Single Phase Transformer
- Study of Subtractive Polarity Test in a Single Phase Transformer
- Study of Open Circuit Test in a Single Phase Transformer
- Study and calculate power factor and equivalent parameters under Open Circuit Test
- Study of Short Circuit Test in a Single Phase Transformer
- Study and calculate power factor and equivalent parameters under Short Circuit Test
- Study of Load Test and correspondingly determine the Efficiency & Regulation of Single Phase Transformer under different loading conditions

Three Phase Transformer (Built-in with Workbench or externally connected)

- Study of Step-up Transformer
- Study of Step-down Transformer
- Study of Open Circuit Test in a Three Phase Transformer
- Study of Short Circuit Test in a Three Phase Transformer
- Study of Load Test and correspondingly determine the Efficiency of Single Phase Transformer under different loading conditions

Three Phase Power Measurement (Built-in with Workbench)

- To measure three phase powers and power factor at resistive (bulb) load
- To measure three phase power and power factor at resistive and inductive load
- To study improvement of power and power factor using capacitive load

BLDC Motor (PS-BLDC05)

- Operational Working Principle and its circuitry
- Load Characteristics
- Speed Control of BLDC Motor using its control circuit

Universal Motor (PS-UM05 to PS-UM30)

- Operational Working Principle and its fundamentals
- Load Characteristic at DC Configured Circuit
- Load Characteristic at AC Configured Circuit

Permanent Magnet DC Motor (PS-PMDC05 to PS-PMDC30)

- Operational Working Principle and its fundamentals
- Load Characteristic

DC Shunt Wound Motor (PS-SHM05 to PS-SHM30)

- Operational Working Principle and its fundamentals
- Running and reversing phenomenon
- No Load Characteristic

- Load Characteristic
- Speed control using armature voltage control
- Speed control using flux field control method
- Determine losses and calculate efficiency by Swinburne's Test Method

DC Series Wound Motor (PS-SM05 to PS-SM30)

- Operational Working Principle and its fundamentals
- Running and reversing phenomenon
- Load Characteristic
- Speed control using armature voltage control
- Speed control using flux field control method

DC Compound Wound Motor (PS-CM05 to PS-CM30)

- Operational Working Principle and its fundamentals
- Running and reversing phenomenon
- Load Characteristic of DC Cumulative Motor with long shunt configuration
- Load Characteristic of DC Cumulative Motor with short shunt configuration

DC Shunt Wound Generator (PS-SHG05 to PS-SHG30)

- Study and measurement of Open Circuit Characteristic
- Study and measurement of External Characteristic
- Study and measurement of Internal Characteristic

DC Series Wound Generator (PS-SG05 to PS-SG30)

- Study and measurement of Open Circuit Characteristic
- Study and measurement of External Characteristic
- Study and measurement of Internal Characteristic

DC Compound Wound Generator (PS-CG05 to PS-CG30)

- Operational Working Principle and its fundamentals
- Load Characteristic of DC Cumulative Generator with long shunt configuration
- Load Characteristic of DC Cumulative Generator with short shunt configuration
- Load Characteristic of DC Differential Generator with long shunt configuration
- Load Characteristic of DC Differential Generator with short shunt configuration

Study and obtain the losses and determine efficiency by Field Test (PS-SSG05 to PS-SSG10)

Study and obtain the losses and determine efficiency by Hopkinson's test (PS-HT05 to PS-HT10)

Ward Leonard Test of Three Phase Induction Motor with Shunt Generator (PS-WL10 to PS-WL30)

Supporting Accessories supplied with Workbench

- Patch Cords of different color scheme of appropriate value
- Single & Three Phase Mains Cord
- Digital Tachometer
- Extra Glass Fuses
- Learning Material Manual (softcopy)
- Resistive Load **(Optional)**
- Sliding Rheostat **(Optional)**
- 8A, Single Phase Autotransformer **(Optional)**
- 8A, Three Phase Autotransformer **(Optional)**
- Single & Three Phase Resistive Load **(Optional)**

****Please feel free to share your requirements by filling your details in ask query section or request a Quote section on the website, we will be happy to cater your requirement.**