Practical No.19: Make the input and output connections of UPS and measure the output voltage under online and offline mode

I Practical Significance:

Uninterruptible Power Supplies (UPS) have important role in various applications where a reliable and continuous power supply is required.

II Industry/Employer Expected Outcome(s):

In industrial, domestic, commercial applications, continuous AC mains supply is needed. The employee is expected to select UPS of suitable ratings and test it under online and offline mode.

III Course Level Learning Outcome(s):

Use relevant diode in different Electronic circuits.

IV Laboratory Learning Outcome(s):

Check the operation of UPS under online and offline mode.

V Relevant Affective Domain related outcome(s):

1. Handle the equipments and components carefully.
2. Follow safety precautions.

VI Relevant Theoretical Background (With diagrams if required):

The purpose of a UPS is to provide emergency power (usually by a lead/acid battery) to a load when it senses that the input power source has failed. They are different from emergency power systems or standby generators because they provide near-instantaneous protection from power interruption by using a battery (which can be a super capacitor or flywheel). The battery itself usually has a short runtime (about 5-20 minutes), but it should be enough to either save all that precious data/progress that you have made, gracefully shut everything down, or fix the problem that caused the outage. A UPS can be used to protect hardware like data centers, computers, and other electrical equipment where an unexpected surge/sag can cause serious problems like data loss, business disruption, and even injuries or fatalities.

Types of Uninterruptible Power Supplies

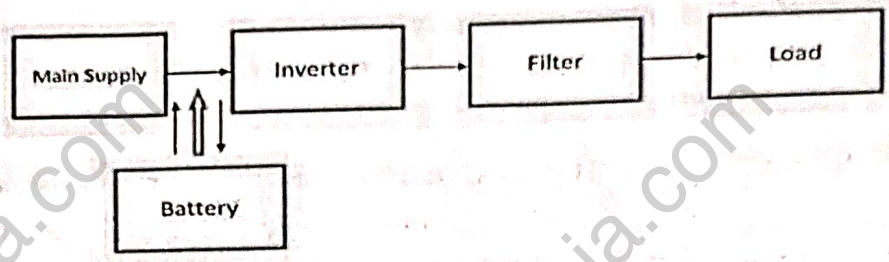
There are three types of uninterruptible power supplies: static, dynamic (rotary), and hybrid. Static uses power electronic converters, dynamic uses electromagnetic engines (generators and motor), and hybrid uses a combination of both static and dynamic.

1. Offline/Standby Uninterruptible Power Supply

The offline/standby UPS is the most basic out of the three. It provides light surge protection and battery back-up. During normal operations, it gets its power from its main power source (generally an AC outlet). Once it senses that the main power source goes beyond acceptable limits or fails, it switches to the "offline/standby" battery where it will then go to the DC/AC inverter power source and battery as such, there will be a small transfer time between the main

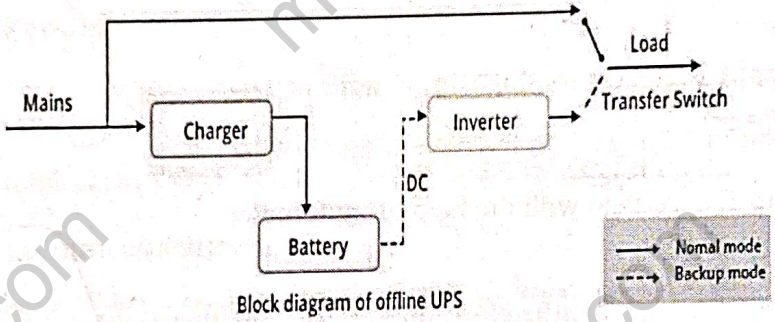
2. Online/Double Conversion Uninterruptible Power Supply

The online/double conversion UPS differs from the offline/standby as the DC/AC inverter is always connected on. This means there will be no transfer time between the main power source and battery, providing greater protection against spikes, sags, electrical noise, and complete power failure.

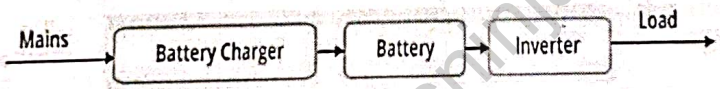


Block Diagram of UPS

VII Actual Circuit diagram used in laboratory with equipment Specifications:



Block diagram of offline UPS



Block diagram of online UPS

VIII Required Resources/apparatus/equipment with specification:

Sr. No.	Name of Resource	Suggested Specifications	Quantity
1.	UPS	Input voltage- 230V AC ±15% single phase Output Voltage- 230V ±1% single phase Power capacity- 1kVA Frequency- 50 Hz ±0.5Hz	1
2.	Digital Multimeter	DMM:3 ½ digit display	1

VIX Precautions to be followed:

1. Do not install UPS in an outdoor area that is open to direct sunlight, moisture, thunderstorms or other drastic climatic conditions.
2. Only a skilled technician should do battery replacement.
3. Do not open the UPS cover unnecessarily.
4. If at all, you have to open the cover for checking any fault, it should be done only after switching the UPS off and disconnecting it from the mains.

X Procedure:

Mains ON:

1. Measure AC input voltage with the help of multimeter.
2. Measure AC output voltage with the help of multimeter.
3. Measure Battery Full Charge DC Voltage with the help of multimeter.

Mains OFF:

1. Measure AC input Voltage with the help of multimeter.
2. Measure AC output Voltage with the help of multimeter.
3. Measure Battery DC voltage with the help of multimeter.

XI Required Resources/apparatus/equipment with specifications:

S. No	Instruments/Components	Suggested broad specification	Quantity
1	digital multimeter	DMM : $3\frac{1}{2}$	1
2	UPS	Input voltage 230 V	1
3	–	output voltage 230V	–
4	–	power capacity - 1kVA	–

XII Actual procedure followed:

* Mains ON:
1. Measure Ac input voltage with help of multimeter
2. Measure Ac output voltage with help of multimeter
3. Measure Battery full charge DC votage with help of multimeter
* mains off:
1. Measure Ac input voltage with help of multimeter
2. Measure Ac output voltage with help of multimeter

3. Measure battery D.C voltage with the help of multimeter.

XIII Observations and Calculations:

Sr.No.	Operating conditions	Input Voltage	Output Voltage
1.	Online Mode	234	52
2.	Offline Mode	—	—

XIV Results:

We have learn to make the input and output connections of UPS and measure the output voltage under online and offline mode.

XV Interpretation of Results:

We have learn to make the input & output connections of UPS and measure the output voltage under online and offline mode.

XVI Conclusions & Recommendations:

We have learn to make the input & output connections of UPS and measure the output voltage under online and offline mode.

XVII Practical Related Questions:

1. What is mean by UPS?
2. List types of UPS.
3. List applications of UPS.
4. State the need of UPS.

[Space for Answers]

Q.1 ------?

→ 1. UPS: UPS stands for Uninterruptible power supply. It is a device that provides backup power to electronic equipment in case of a power outage or voltage fluctuation.

Q.2 - - - - ?

→ There are two types of UPS:
1. offline UPS
2. online UPS

Q.3 - - - - ?

→ 1. Computers and IT Equipment
2. Medical Equipment
3. Telecommunications
4. Industrial Control Systems
5. Security Systems
6. Financial Institutions
7. Emergency Lighting Systems
8. Home Appliances and Entertainment Systems

Q.4 - - - - ?

→ - A UPS is needed to provide backup power during electrical outages or disruptions, ensuring that sensitive electronic equipment (like computers, servers, or medical devices) continues to operate without interruption.
- Certain applications are personal computer, ICU (intensive care unit).

XVIII References/ suggestions for further reading ; includes websites:

1. UPS Working Principle and Types - Offline and Online UPS Systems
2. Microsoft Word - MpBe002c_Energieeffizienz von USV-Anlagen_Schlussbericht.doc