

# SWITCHED MODE POWER SUPPLY (SMPS)



# Contents:-

- General description of Power Supply
- Basic principle of PSU and description of main parts
- Block diagram of SMPS
- Comparison over Linear supply
- Advantages/Disadvantages of SMPS
- Applications of SMPS
- What is UPS
- Type of UPS
- UPS Component
- Block diagram of Different UPS
- Advantages/Disadvantages of UPS
- Applications of UPS

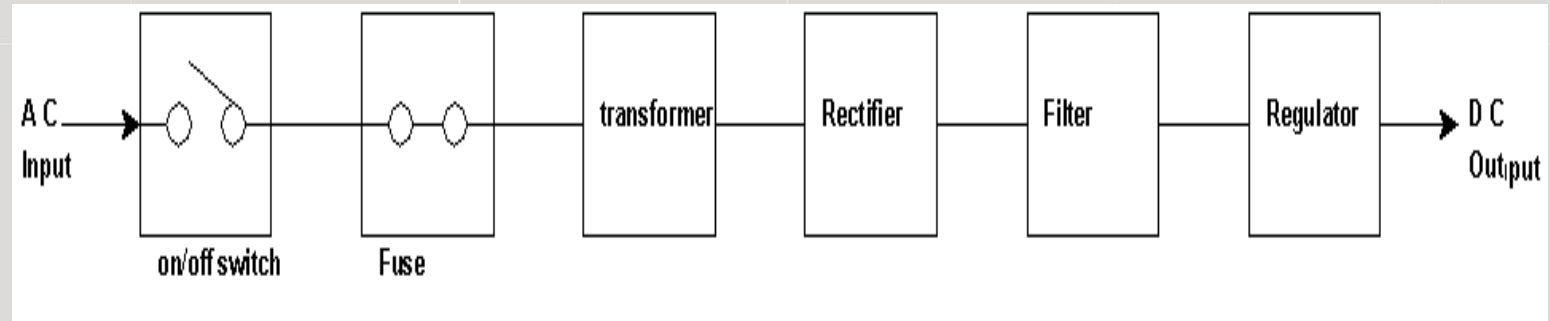


# Why power supplies?

- Power supplies provide the necessary power, voltage and current requirements for electronic devices.
- They usually change ac to dc voltage.
  - For example, 120 volts ac is changed to 13.8 volts dc.



# Basic Principles of PSU Circuits

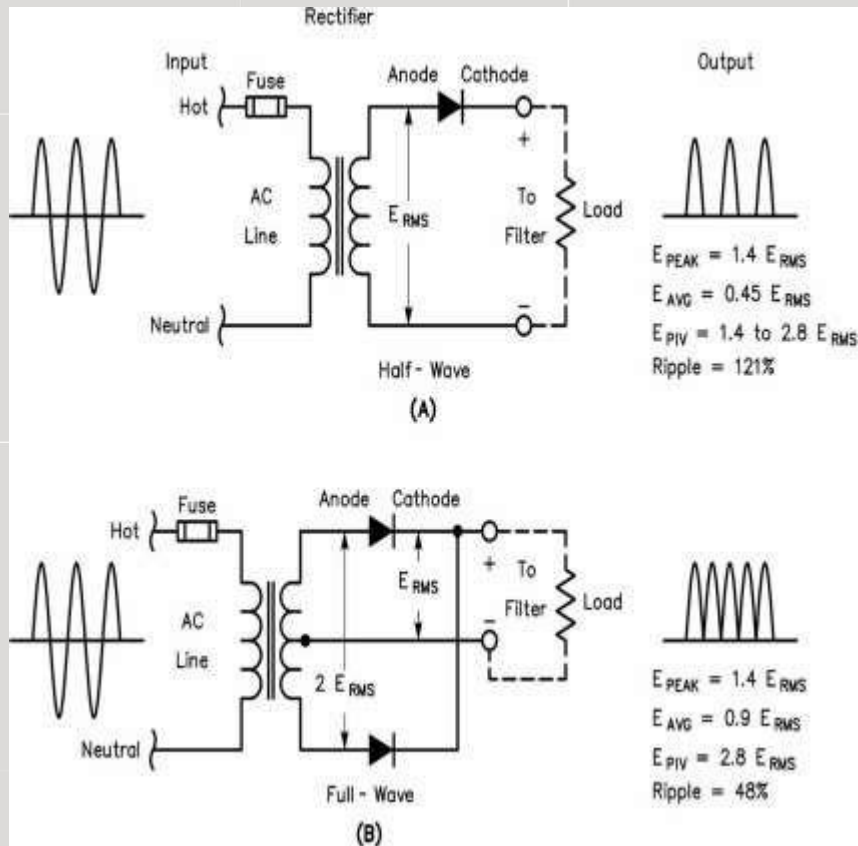


**Consist of:**

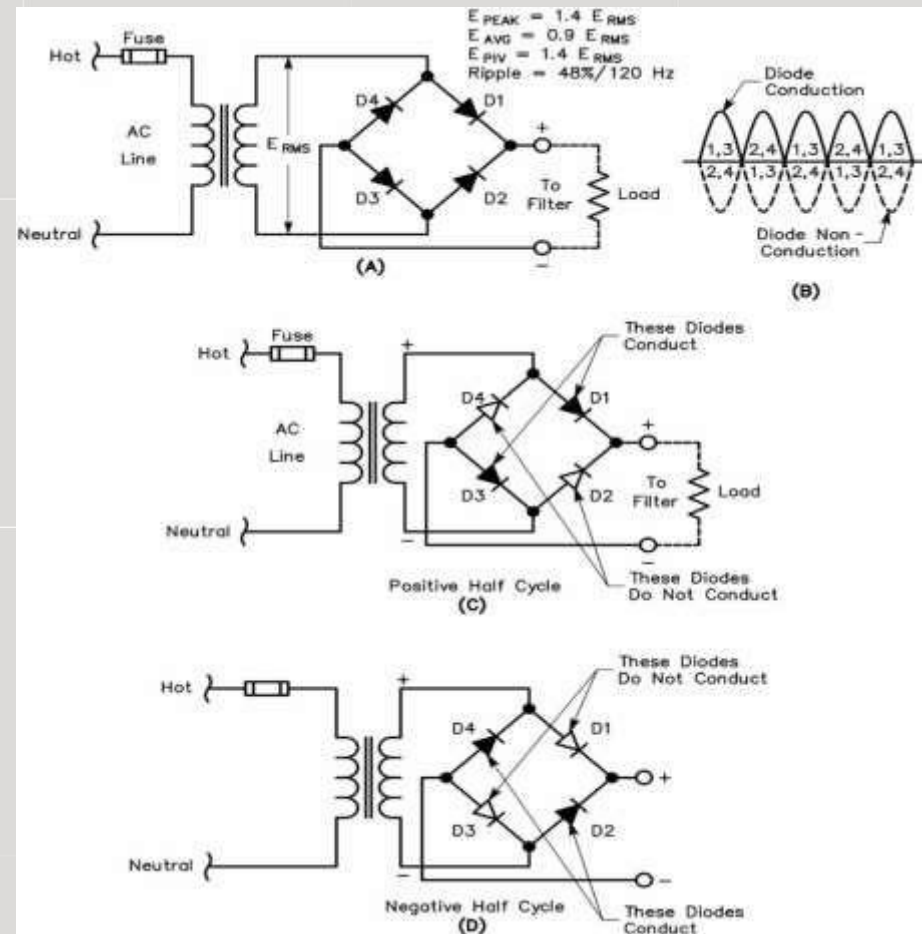
- 1. Transformer - steps ac voltage up or down.**
- 2. Rectifier Diodes - change ac to “ripple” dc.**
- 3. Filter Network - includes capacitors and inductors, smooth out the ripples.**
- 4. Voltage Regulator - keeps the voltage constant.**

# Power Supply Specifics

## Half Wave - Full Wave Rectifier

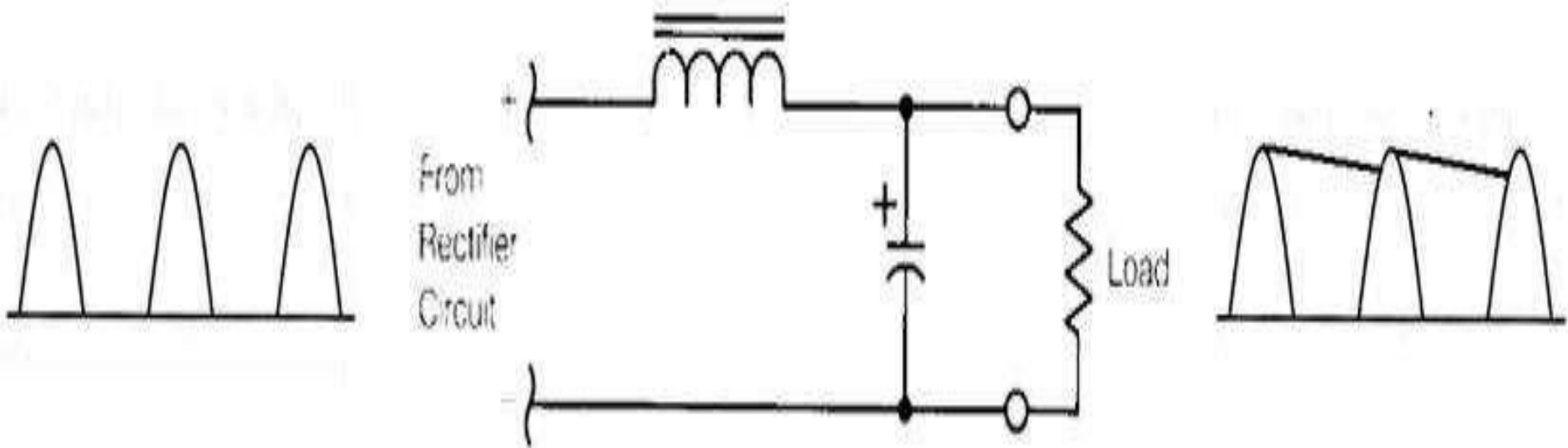


## Bridge Rectifier



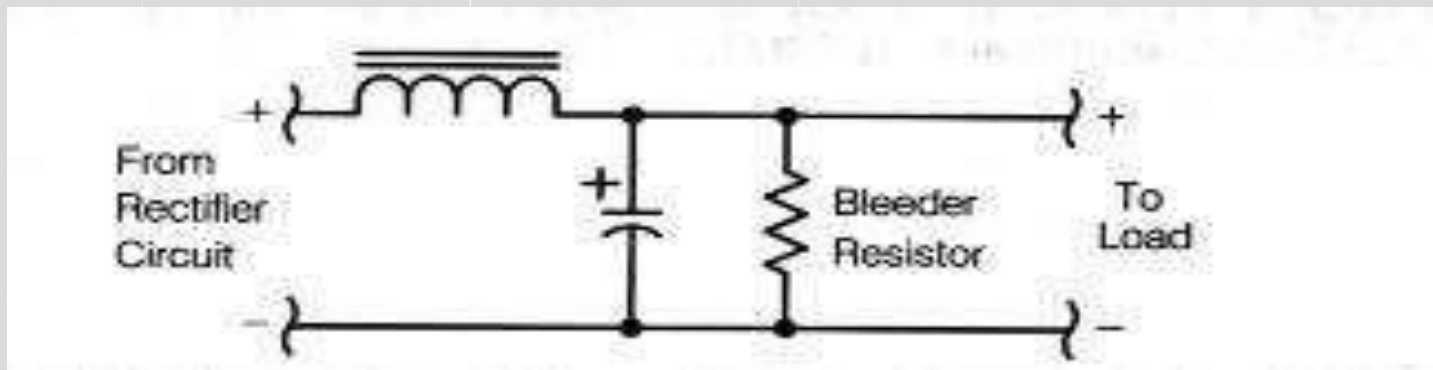
# Power Supply Filters

- Capacitors and inductors are used in power supply filter networks. The capacitors and inductors smooth out the “ripple” ac to dc.



# Power Supply Safety

- Grounding is important.
- Connection integrity is important.
  - Somewhere neutral and ground are connected together.
- Bleeder resistors across the filter capacitors “bleed off” charge when supply is turned off.



# Switched Mode Power Supply:

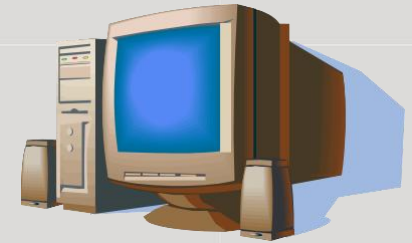
- ❑ An electrical power supply that incorporates a switching regulator to convert electrical power efficiently.



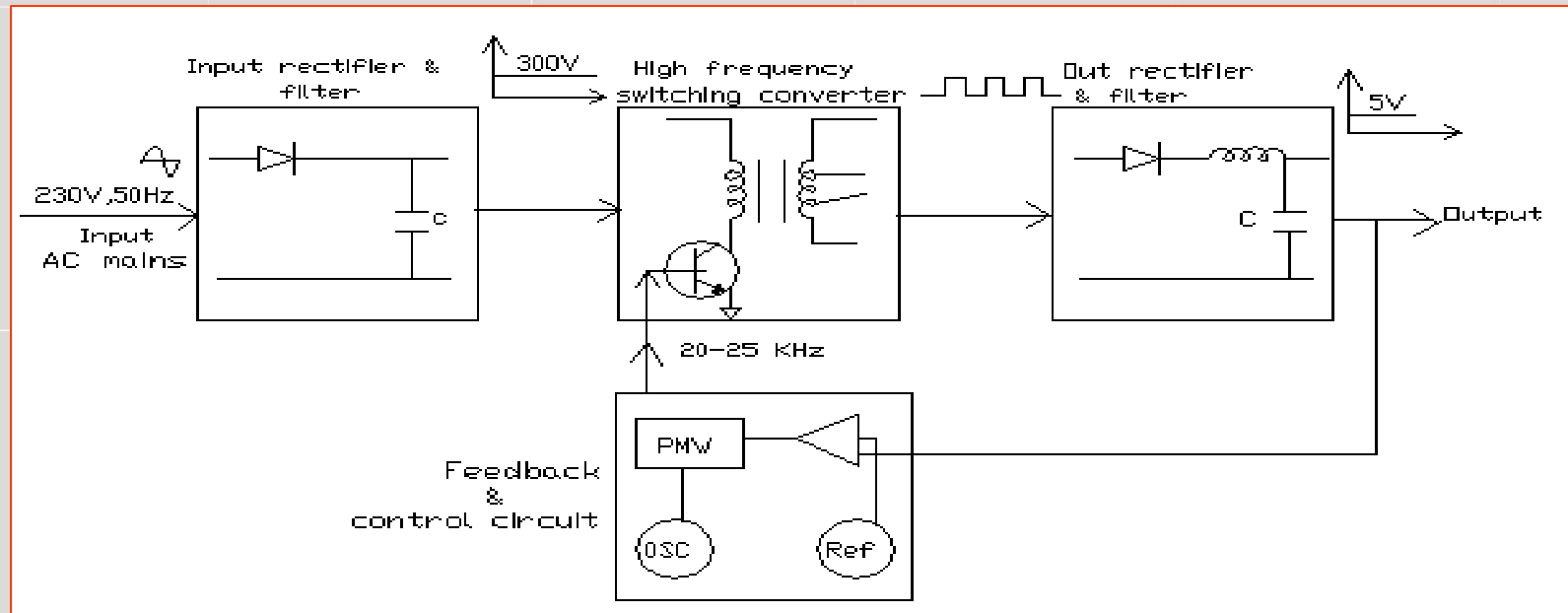
- ❑ It transfers power from a source, to a load, while converting voltage and current characteristics.
- ❑ Voltage regulation is achieved by varying the ratio of on-to-off time.



# Block diagram of a SMPS



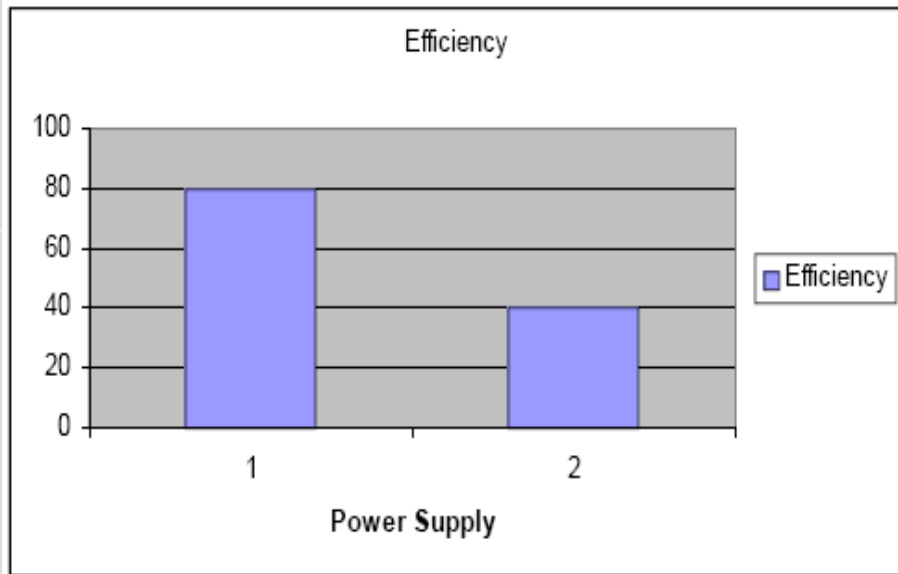
## Functional Block Diagram of SMPS



# Linear and SMPS Comparison

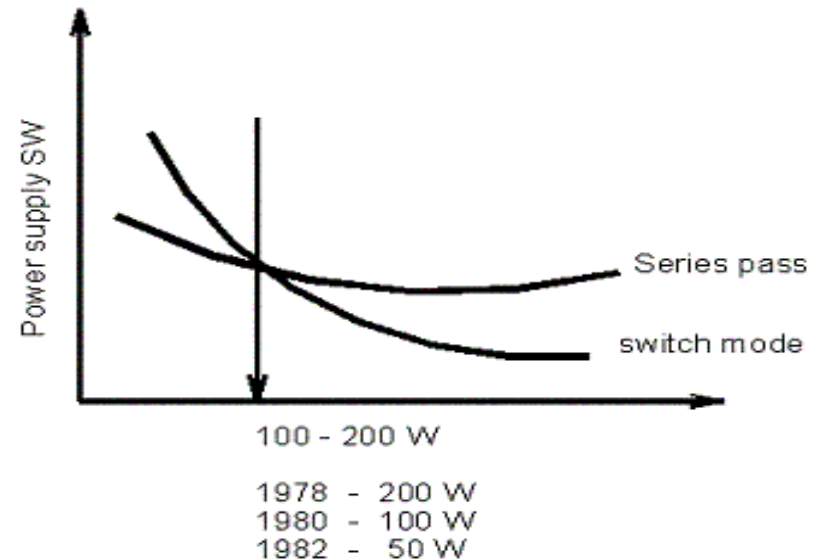
## Efficiency :

- *Efficiency comparisons between series pass and switch mode power supply*



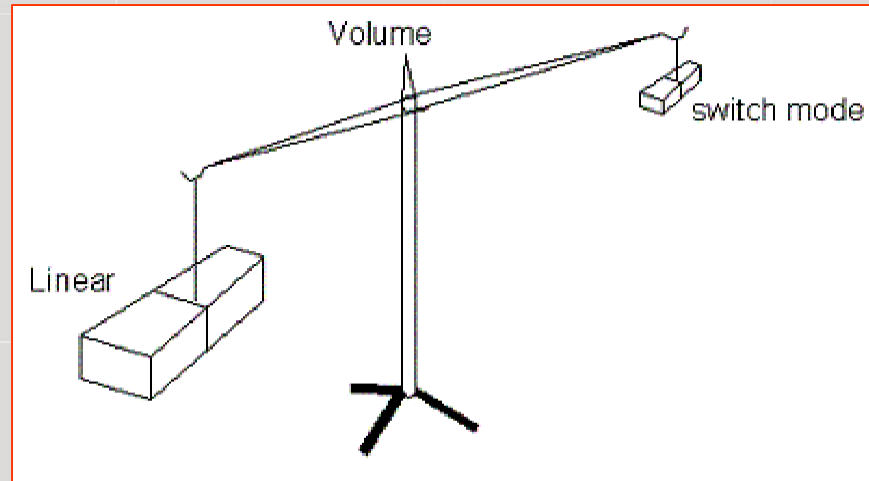
## Cost :

- *Cost comparison between series pass and switch mode power supply*



# Linear and SMPS Comparison

- Volume / Weight :



- Adjustable Frequency :

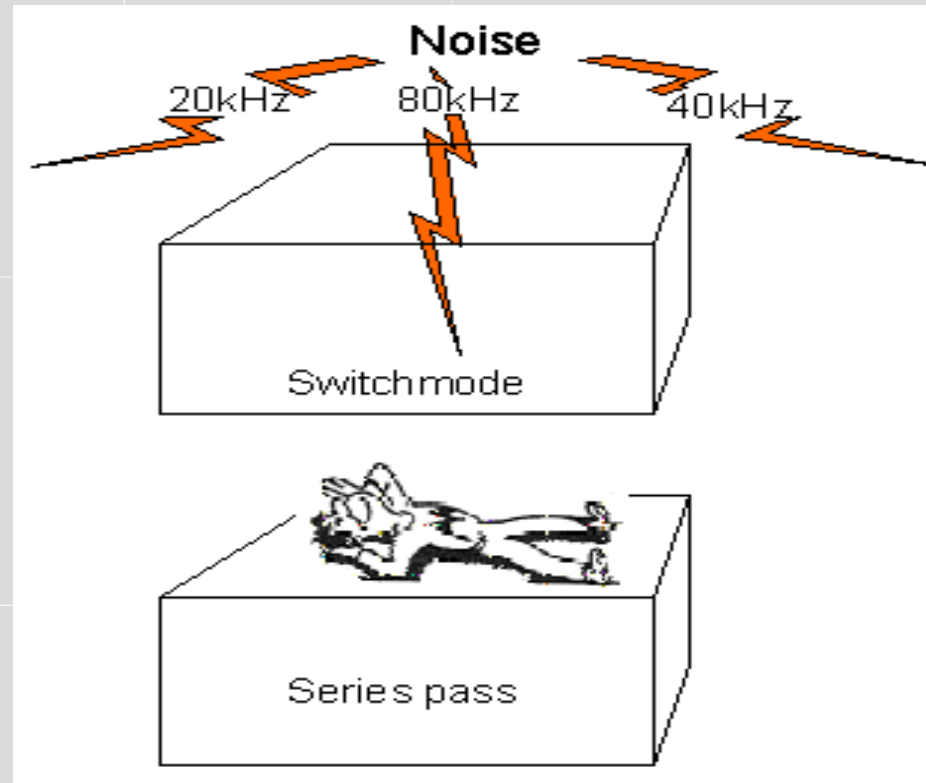
Switch mode allows adjusting the frequency  
from 1 to 300 kHz

- Flexibility :

SMPS more flexible due to capability of adjusting frequency

# Linear and SMPS Comparison

- **Noise :**



Noise comparison between series pass and SMPS

# Advantages & Disadvantages of SMPS over Linear Power Supplies:

## Advantages of SMPS:

1. Lower weight
2. Smaller size
3. Higher efficiency
4. Lower power dissipation
5. Wide ac input voltage range
6. Reduced costs

## Disadvantages of SMPS:

1. Complexity of the circuit



# Applications of SMPS:-

- 1. Machine tool industries
- 2. Security Systems  
(Closed circuit cameras)
- 3. Support supplies with PLC's
- 4. Personal Computers
- 5. Mobile Phone chargers



# SMPS in Indian markets:



**iball 600W**  
Rs. 4700



**Antec 750W**  
Rs. 6600



**Cooler master 550W**  
Rs. 3800



**Seasonic 500W**  
Rs. 3600



**UMAX 450W**  
Rs. 570



**Corsair 750W**  
Rs. 10700

# UNINTERRUPTIBLE POWER SUPPLIES

**AN UNINTERRUPTIBLE POWER SUPPLY (UPS) IS A DEVICE THAT HAS AN ALTERNATE SOURCE OF ENERGY THAT CAN PROVIDE POWER WHEN THE PRIMARY POWER SOURCE IS TEMPORARILY DISABLED**



**THE SWITCHOVER TIME MUST BE SMALL ENOUGH TO NOT CAUSE A DISRUPTION IN THE OPERATION OF THE LOADS**



# WHY USE A UPS?



- **PROTECTS AGAINST MULTIPLE TYPES OF POWER DISTURBANCES**
- **ONLY DEVICE THAT PROTECTS AGAINST AN OUTAGE**
- **OFFERS PROTECTION AGAINST**
  - **EQUIPMENT NOT OPERATING PROPERLY**
  - **COMPUTER AND EQUIPMENT DAMAGE**
  - **DATA LOSS**
  - **TIME AND EXPENSE TO RECOVER BACK TO WHERE YOU WERE, IF EVEN POSSIBLE**



# Types Of UPS

**UPS**

**ON Line UPS**

**OFF Line UPS**

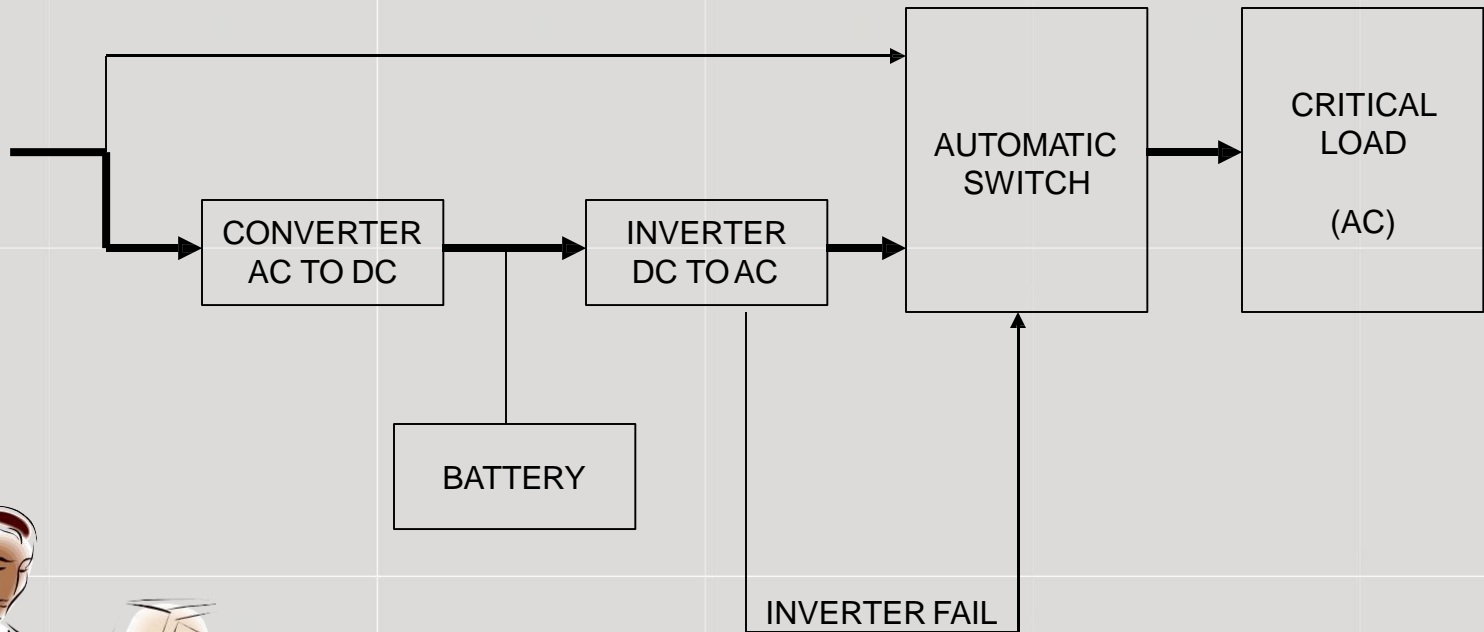


# UPS COMPONENTS

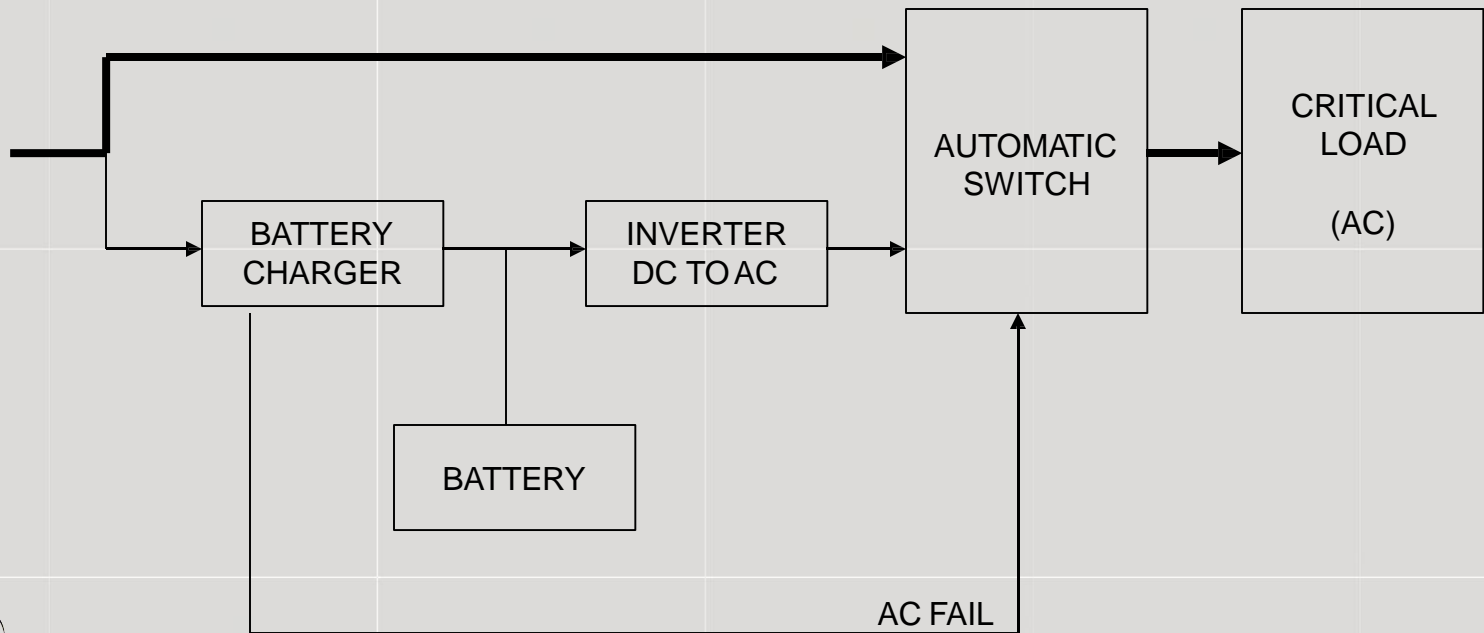
- **CONVERTER - AC TO DC**
  - **SPD - PROTECTS AGAINST SPIKES AND TRANSIENTS**
- **BATTERY**
  - **STORED ENERGY DEVICE -  
PROTECTS AGAINST INTERRUPTIONS**
- **INVERTER - DC TO AC**
  - **WAVEFORM SYNTHESIS -  
PROTECTS AGAINST DC OFFSET AND INTERHARMONICS**
  - **FILTER - PROTECTS AGAINST HARMONICS, NOTCHING AND NOISE**
  - **VOLTAGE REGULATOR - PROTECTS AGAINST SAGS, SURGES AND  
FLUCTUATIONS**
- **MONITOR AND CONTROL HARDWARE / SOFTWARE**



# BLOCK DIAGRAM ON LINE UPS



# BLOCK DIAGRAM OFF LINE UPS



# ADVANTAGES / DIS-ADVANTAGES OF THE DIFFERENT UPS ARCHITECTURES

## OFF LINE UPS ADVANTAGES

- AC TO DC CONVERTER / BATTERY CHARGER DOES NOT HAVE TO PROVIDE FULL LOAD POWER (POTENTIALLY CHEAPER)
- LESS STRESS ON DC TO AC INVERTER SINCE IT RUNS AT NO LOAD UNTIL UPS SWITCHES TO BATTERY POWER (POTENTIALLY CHEAPER)

## ON-LINE UPS ADVANTAGES

- ZERO SWITCHOVER TIME FROM MAIN LINE TO BATTERY POWER
- ALWAYS ISOLATED FROM POWER DISTURBANCES ON THE MAIN LINE

# Applications of UPS:-

- UPS are used in computers, data processors, data transmitters, microwave relay station, digital controllers and nuclear reactor control system.



**THANK YOU**