

Introduction of Power Electronics

The electrical engineering field is generally divided into three areas of specialization:

1. Electronics
2. Power
3. Control

Electronics essentially deals with the study of semiconductor devices and circuits for the processing of information at lower power levels. In this rapidly developing scenario electronics is the most important branch of engineering. The Power area deals with both the rotating and static equipment for the generation, transmission, distribution & utilization of vast quantities of electrical power. The transmission & distribution system is a very vital link between generation & utilization of electrical power in a country. Power Electronics deals with the use of electronics for the control & conversion of large amount of electrical power. The design of Power Electronic equipment involves interaction between the source and the load, & utilizes small signal electronic control circuits as well as power semiconductor devices. Therefore, Power Electronics depends upon all other areas of electrical engineering. The major components of the power electronic circuits are the thyristors. Therefore power electronics relates to thyristor circuitry, its design & role in the control of power flow in the system. Thyristor is a fast switching semiconductor & its function is to modulate the power in AC & DC systems. The Power Electronics Circuits are also called Thyristorized Power

Converters. These controllers are generally classified into the following five broad categories:

1. Phase controlled rectifiers
2. Inverters
3. Choppers
4. Cycloconverters
5. AC regulators

1. **Phase Controlled Rectifiers:** These controller convert fixed AC voltage to a variable DC output voltage. These controller circuit use line voltage for their commutation. Hence they are also called as line commutated or naturally commutated AC to DC converters. These circuit include diode rectifiers and single phase or three phase controlled circuits. Such converters are widely used for controlling the DC drives used at rectifier side of the uninterruptible power supplies (UPS) used in

metallurgical and chemical industries, and in high voltage DC transmission systems.

2. **Inverter:** An inverter converts a fixed DC voltage to an AC voltage of variable frequency and of fixed or variable magnitude. This type of controllers use forced commutation methods to turn off the thyristors. Inverter are widely used in induction motors and synchronous motor drives, induction heating, UPS, HVDC transmission and so on .
3. **Chopper:** A chopper converts fixed DC input voltage to a variable DC output voltage: therefore, choppers are also referred as DC to DC converters. In these controller circuits, forced commutation is used to turn off the thyristors. Choppers find wide applications in DC drives, subway cars, trolley trucks, battery driven vehicles and so on.
4. **Cycloconverter:** These circuits convert input power at one frequency to output power at a different frequency through one stage conversion. The cycloconverters are most commonly used for obtaining low frequency AC voltage. These are mainly used for slow speed large AC drives like rotary kilns and traction vehicles.
5. **AC Voltage Regulators:** These converters convert fixed AC voltage directly to a variable AC voltage at the same frequency using line commutation AC regulators are mainly employed for speed control of large fans and pumps.