1.3 Recent power semiconductor switching devices

Diodes, thyristors and transistors are the essential component of the power electronic applications. Today, the single wafer diodes are able to block more than 9 kV over a wide temperature range. At the same time, thyristors withstand more than 10 kV. Thesedevices conduct up to 5 kA. The levels of 6 kV and 0.6 kA are approachable by power transistor. A comparative diagram of power ratings and switching speeds of the controlled semiconductor electronic devices is given in Figure 1.10.

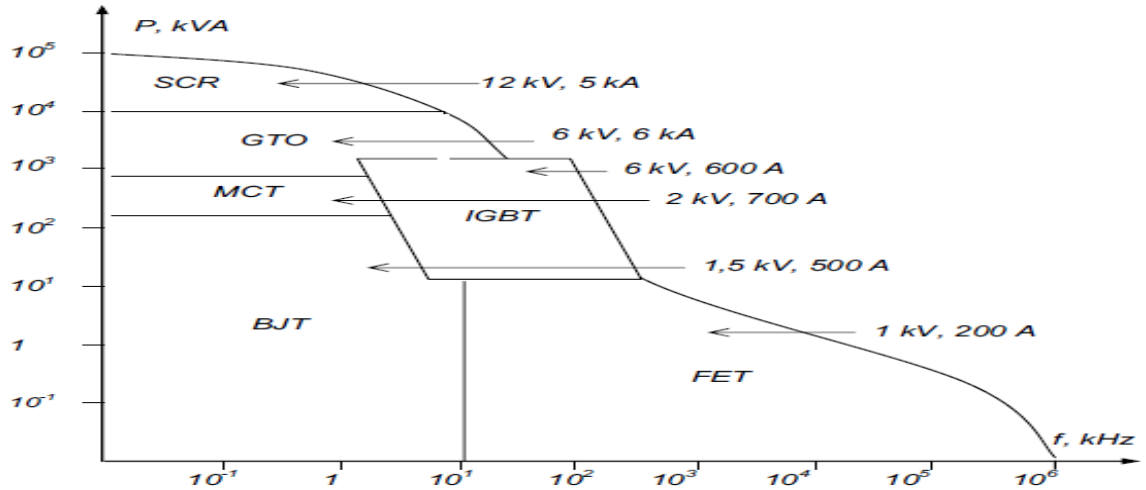

Figure 1.10: A comparative diagram of power ratings and switching speeds of the controlled semiconductor electronic devices.

1.5 Power Electronic Systems:

The major components of a power electronic system are shown in the form of a block diagram in Figure (1.11). Main power source may be an ac supply system or a dc supply system. The output from the power electronic circuit may be variable dc, or ac voltage, or it may be a variable voltage and frequency. In general, the output of a power electronic convertor circuit depends upon the requirements of the load. For example, if the load is a dc motor, the converter output must be adjustable direct voltage.

In case the load is a 3-vhase induction motor, the converter may have adjustable

voltage and frequency at its output terminals.

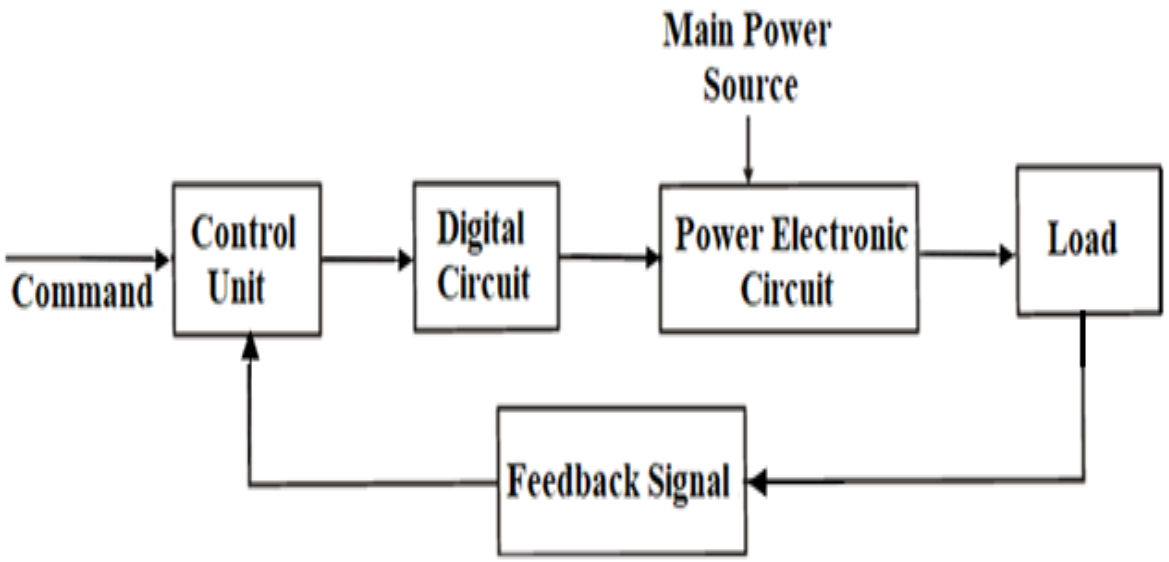

Figure (1.11): Block diagram of a typical power electronic system.

The feedback component in Figure (1.11) measures a parameter of the 1oad, say speed in case of a rotating machine, and compares it with the command.

The difference of the two, through the digital circuit components, controls the instant of turn-on *of* semiconductor devices forming the solid-state power converter system. In this manner, behaviour of the load circuit can be controlled, as desired, over a wide range with the adjustment of the command.

1.6 Some Applications of Power Electronics:

The development of new power-semiconductor devices, new circuit topologies with their improved performance and their fall in prices have opened up wide field for the new applications of power electronic converters.

No boundaries can be earmarked for the applications of power electronics, especially with the present trend of integrated design of power-semiconductor devices,

microprocessors and the controlled equipment. The power ratings of power-electronic systems range from a few watts in lamps to several hundred megawatts in HVDC transmission systems. It is believed that in the early twenty-first century, 60 to 80% of the electric power consumed in utility systems will pass through power-electronics and this figure will eventually reach 100% in the future.

There are some applications of power electronic:

1. **Aerospace:**

   Space shuttle power supplies, satellite power supplies, aircraft power systems.

2. **Commercial:**

   Advertising, heating, air-conditioning, central refrigeration, computer and office equipment, uninterruptible power supplies, elevators, light dimmers and flashers.

3. **Industrial:**

   Arc and industrial furnaces, blowers and fans, pumps and compressors, industrial lasers, transformer-tap changers, rolling mills, textile mills, excavators, cement mills, welding.

4. **Residential:**

   Airconditioning, cooking, lighting, space heating, refrigerators, electric-door openers, dryers, fans, personal computers, other entertainment equipment, vacuum cleaners, washing and sewing machines, light dimmers, food mixers, electric blankets, food-warmer trays.

5. **Telecommunication:**

   Battery chargers, power supplies (dc and UPS).

6. **Transportation:**

Battery chargers, traction control of electric vehicles, electric locomotives street cars, trolley buses, subways, automotive electronics.

7. Utility systems:

High voltage dc transmission (HVDC), excitation systems, VAR compensation, static circuit breakers, fans and boiler-feed pumps, supplementary energy systems (solar, wind).