



POWER ELECTRONICS
SECOND CLASS

Prepared by

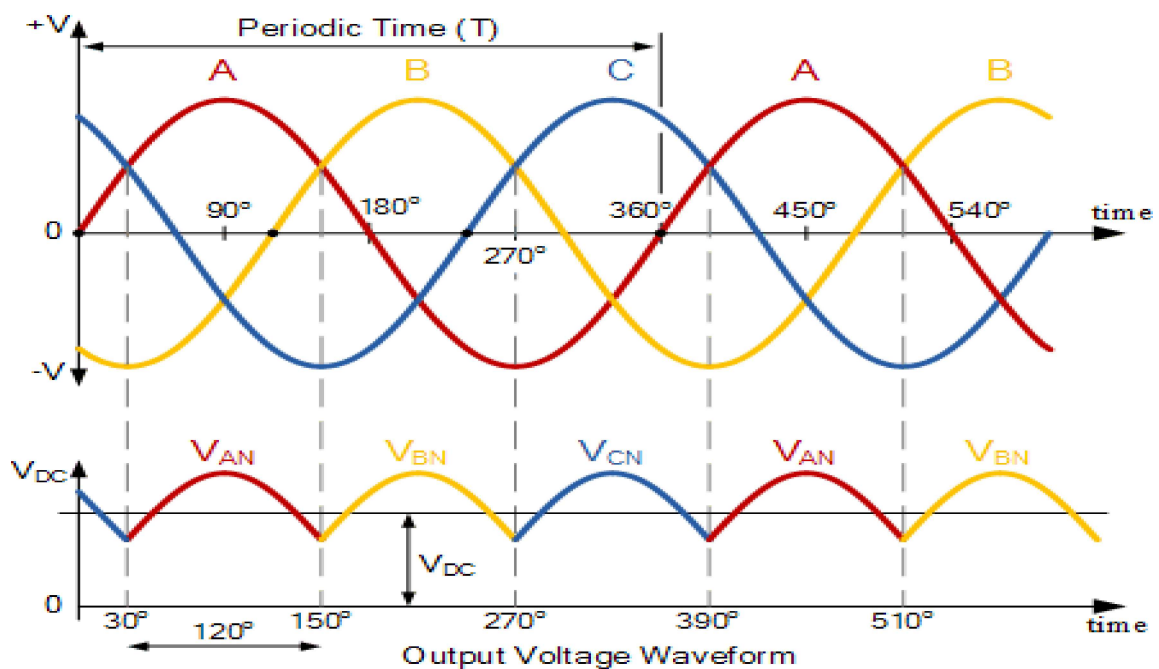
Assist. Lecturer: Abdulghafor A. Abdulhameed

Southern technique university

Qurna technical institute

Chapter one

Rectifiers



Chapter Outline: -

- 1.1 Introduction
- 1.2 Main power devices
- 1.3 Rectifiers

1-1 : Introduction

Power Electronics is the study of switching electronic circuits in order to control the flow of electrical energy. Power Electronics is the technology behind switching power supplies, power converters, power inverters, motor drives.

The power devices are mainly used such as:-

1) Switches to convert power from one form to another.

a- **ac** to **dc** converters (rectifier) b- **ac** to **ac** converters (cyclo-converters)

c- **dc** to **ac** converters (inverters) d- **dc** to **dc** converters (choppers)

2) In motor control systems

3) Uninterrupted power supplies (UPS)

4) High-voltage dc transmission

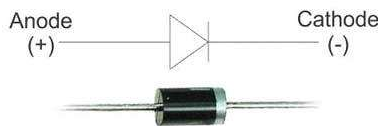
5) power supplies

6) Induction heating

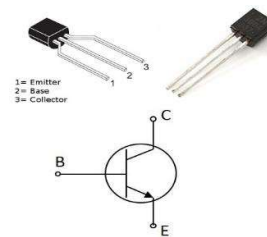
1-2: Main power devices: -

The main semiconductor power devices are listed her with both construction and real appearance

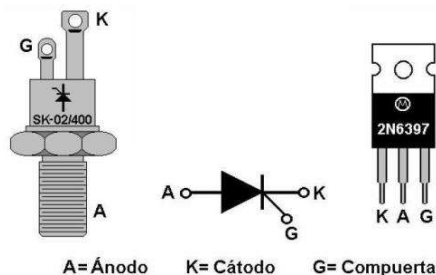
1) P-N junction diodes



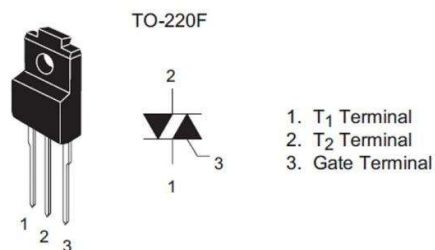
2) Bipolar transistor BJTs



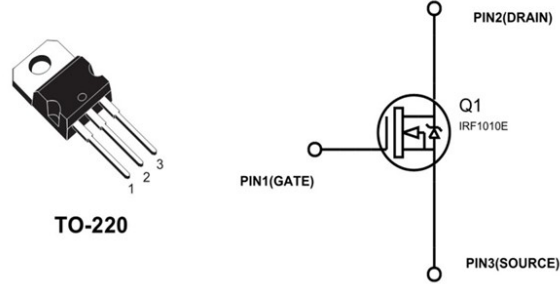
3) Gate Turn-off thyristors GTOs



4) Diacs and Triacs



5) MOSFETs



1.3: Rectifiers

A rectifier is an electrical device that converts an Alternating Current (AC) into a Direct Current (DC) by using one or more P-N junction diodes.



Rectifier can be classified in to two type

- 1- Single phase rectifier ---
 - a) Half-wave rectifier
 - b) Full-wave rectifier
 - c) Bridge - rectifier
- 2- Three phase rectifier ---
 - a) Half- wave rectifier
 - b) Bridge - rectifier

1.3.1: Three phase half -wave rectifier

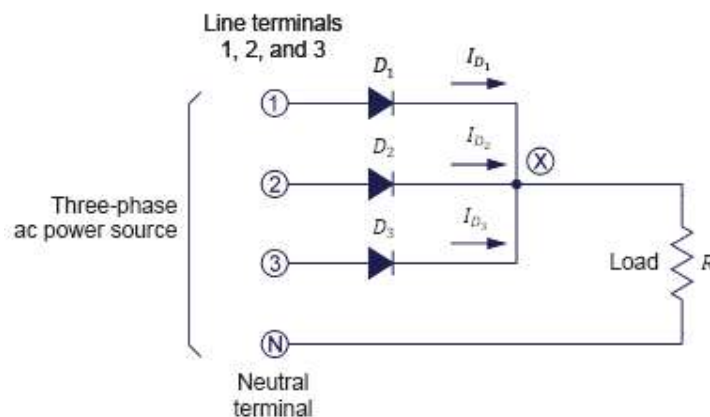


Fig. (1-1) Power circuit diagram of three phase half- wave rectifier

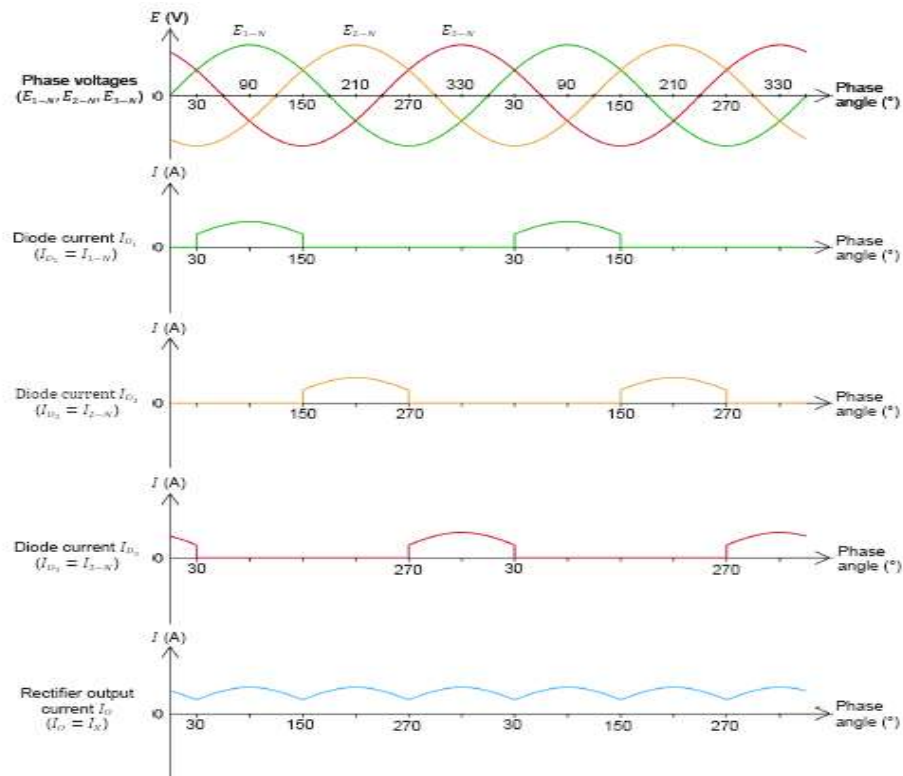


Fig. (1-2) Voltage and current wave from of 3-ph half wave rectifier

$$I_{dc} = \frac{1}{2\pi/3} \int_{\pi/6}^{5\pi/6} \sin(\omega t) d(\omega t) \quad (1)$$

$$I_{dc} = \frac{3}{2\pi} [-I_m \cos(\omega t)]_{\pi/6}^{5\pi/6} \quad (2)$$

$$I_{dc} = \frac{3}{2\pi} [-I_m \cos(5\pi/6) + I_m \cos(\pi/6)] \quad (3)$$

$$I_{dc} = \frac{3I_m}{2\pi} \left[\left(\frac{\sqrt{3}}{2} \right) + \left(\frac{\sqrt{3}}{2} \right) \right]$$

$$I_{dc} = \frac{3\sqrt{3}I_m}{2\pi} \quad (4)$$

$$V_{dc} = I_{dc}R_L \quad (5)$$

$$I_m = \frac{V_m}{R_L} \quad (6)$$

$$P_{dc} = I_{dc}^2 R_L = \frac{V_{dc}^2}{R_L} \quad (7)$$