Department of Electrical Engineering

Assignment

Date: 24/06/2020

Course Details

Course Title: Electronics **Module:** 2nd

Instructor: Sajid Nawaz **Total Marks:** 50

Student Details

Name: M Usman Asim **Student ID:** 16413

Q1	**a)** Explain Rectifier with half wave and full wave rectification. **b)** Differentiate between intrinsic and extrinsic semiconductor.	**(20 marks)**
Q2	**a)** What is Transistor? Differentiate between BJT and FET. **b)** Differentiate between Inverting and non-inverting amplifier.	**(20 marks)**
Q3	**a)** Differentiate between Active and saturation region of transistor**.** **b)** Differentiate between NPN and PNP transistor.	**(10 marks)**

Q1a) Explain Rectifier with half wave and full wave rectification.

Answer:

Rectifier:

A rectifier is an electrical device composed of one or more diodes that converts alternating current (AC) to direct current (DC). A diode is like a one-way valve that allows an electrical current to flow in only one direction. This process is called rectification.

A rectifier can take the shape of several different physical forms such as solid-state diodes, vacuum tube diodes, mercury arc valves, silicon-controlled rectifiers and various other silicon-based semiconductor switches.

Rectifiers are used in various devices, including:

- DC power supplies
- Radio signals or detectors
- A source of power instead of generating current
- High-voltage direct current power transmission systems
- Several household appliances use power rectifiers to create power, like notebooks or laptops, video game systems and televisions.

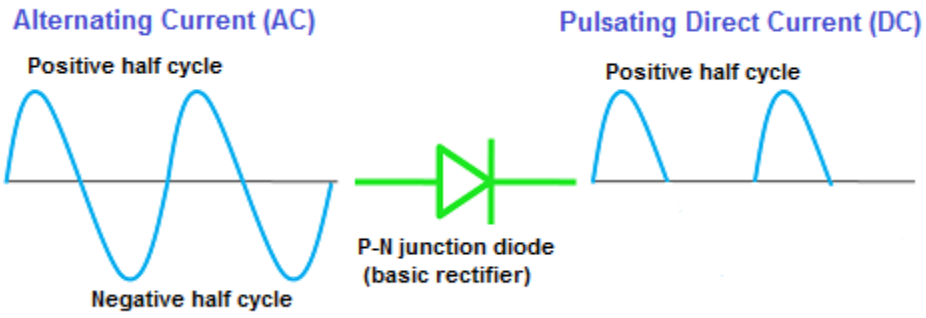
Half wave rectification:

The half wave rectifier is the simplest form of the rectifier. We use only a single diode to construct the half wave rectifier.

A half wave rectifier is a type of rectifier which converts the positive half cycle (positive current) of the input signal into pulsating DC (Direct Current) output signal.

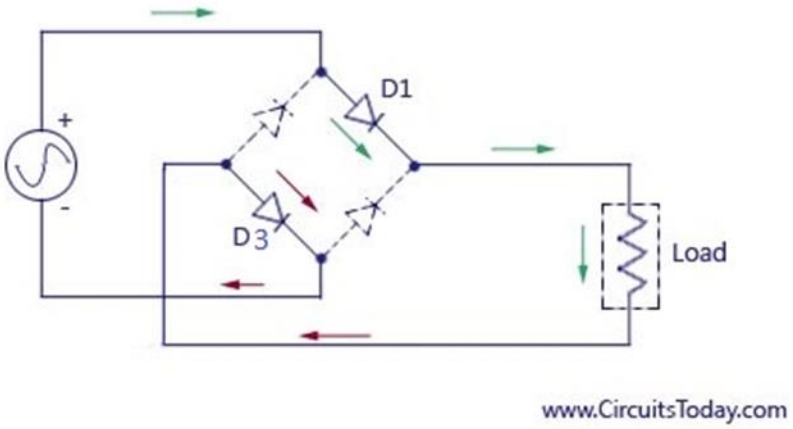
or

A half wave rectifier is a type of rectifier which allows only half cycle (either positive half cycle or negative half cycle) of the input AC signal while the another half cycle is blocked.



Full wave rectification:

A Full wave rectifier is a circuit arrangement which makes use of both half cycles of input alternating current (AC) and converts them to direct current (DC). In our tutorial on Half wave rectifiers, a half wave rectifier makes use of only one-half cycle of the input alternating current. Thus a full wave rectifier is much more efficient (double+) than a half wave rectifier. This process of converting both half cycles of the input supply (alternating current) to direct current (DC) is termed full wave rectification.
Full wave rectifier can be constructed in 2 ways. The first method makes use of a centre tapped transformer and 2 diodes. This arrangement is known as Center Tapped Full Wave Rectifier. The second method uses a normal transformer with 4 diodes arranged as a bridge. This arrangement is known as a Bridge Rectifier.



Q1 b) Differentiate between intrinsic and extrinsic semiconductor.

Answer:

Difference Between Intrinsic and Extrinsic Semi conductor

- In an intrinsic semiconductor, the addition of impurity with a pure semiconductor does not take place, whereas the extrinsic semiconductor is formed by doping of impurity in a pure semiconductor.
- The density of electrons and holes in the intrinsic semiconductor is same, i.e. the number of free electrons present in the conduction band is equal to the number of holes in the valence band.but in the case of extrinsic semiconductor the number of electrons and holes are not equal. In a p-type semiconductor, the holes are in excess and n-type semiconductor the number of electrons is greater than the number of holes.

- The electrical conductivity of an intrinsic semiconductor is low**,** whereas in extrinsic semiconductor the electrical conductivity is high.
- The impurity like arsenic, antimony, phosphorus, aluminium indium, etc. is added to the pure form of silicon and germanium to form an extrinsic
- semiconductor. The pure form of silicon and germanium crystal is used in an intrinsic semiconductor.
- Electrical conductivity in intrinsic semiconductor is a function of temperature alone, but in extrinsic semiconductor the electrical conductivity depends upon the temperature and the amount of impurity doping in the pure semiconductor.

Q2 **a)**What is Transistor? Differentiate between BJT and FET.

Answer:

Transistor:

A transistor is a device that is used to control current flow. It is made of three layers of semiconductor material. The construction is similar to the diode. Transistors often take the place of mechanical switches and relays. A transistor can be thought of as two diodes that share a common center layer.

A three lead semiconductor device that acts as;

an electrically controlled switch, a current amplifier.

Difference between BJT and FET:

BJT:

(1) It is referred to be as a transistor with bipolar junction.
(2) In this type of transistor the operation is dependent on both the charge carriers.
(3) This device is known for its current control.
(4) The offset voltage is required.
(5) Consumption of power is more.
(6) The gain is more in this type of transistor.
(7) The output value of impedance becomes high because of its gain value is high.
(8) The requirement of low currents makes this transistor in use.

FET:

(1) It is a transistor with uni junction

(2) In FET the operation performed is due to the majority of the carriers it may be either electrons or due to holes.
(3) There is no requirement of offset voltage.
(4) Consumption of power is less
(5) This device is known for its voltage control.
(6) These transistors gain will be less.
(7) Low voltage requirements utilize FET.
(8) Lesser the gain lesser the value of the output impedance

Q2: **b)** Differentiate between Inverting and non-inverting amplifier

Answer:

Inverting Amplifiers:

1. The relation between the input and the output signal generated is with 180 degree phase shift.
2. The ratio in between the resistors gives the amplifier gain for these amplifiers
3. In this type of amplifiers the slew rate and CMRR is high.
4. The non-inverting input terminal is connected to the ground.

Non-Inverting Amplifiers:

1. In this amplifier the output generated is the same as that of the applied input.
2. . In this case one plus the ratio of the resistors determines the non-inverting gain for these amplifiers.
3. In this type the amplifier functionality is dependent on the non-inverting terminal
4. The inverting input terminal is connected to the ground in these types of amplifiers.

Q3 a)

Differentiate between Active and saturation region of transistor**.**

Answer:

Saturation region:

The point where the load line intersects the IB = IB(sat) curve is called saturation. At this point, the base current is maximum and so is the collector current. At saturation, collector-base junction no longer remains reverse biased and normal transistor action is lost

Active region:

The region between cut off and saturation is known as active region. In the active region, collector-base junction remains reverse biased while base-emitter junction remains forward biased. Consequently, the transistor will function normally in this region.

Q3 b) Differentiate between NPN and PNP transistor.

Answer:

Difference In	NPN Transistor	PNP
Minority Charge Carrier	Hole	Electron
Small current	Flows from emitter-to-base	Base to emitter
Ground Signal	Low	High
Positive Voltage	Collector Terminal	Emitter Terminal
Forward Biased	Emitter Base Junction	Emitter Base Junction
Reverse Biased	Collector Base Junction	Collector Base Junction