CHAPTER 4

RECTIFIERS & AMPLIFIERS

LEARNING OBJECTIVES

A student can understand the following in this Chapter

1. Identify the various sections of a power supply
2. State the purpose of each section of a power supply
3. Describe the purpose of various types of rectifier circuits used in power supply.
4. Describe the purpose of the filter circuits used in power supply
5. Understand the basic structure of the bipolar junction transistor (BJT)
6. Working principles of NPN transistor
7. Know the transistor configuration as an amplifier (or) a switch
8. Applications of transistor

4.1. INTRODUCTION

Generally every piece of electronics equipment in the world today is powered from a DC Source. This source may be either a battery or a power supply. Most electronics equipment requires not only a DC power source, but one that is well filtered and well regulated as well.

Three types of electronic power conversion devices are in common use today:

1. AC to DC Rectifier
2. DC to DC Converter
3. DC to AC inverter.

4.1.1 AC to DC Rectifier

It is a device which rectifies alternative current into direct current.

Applications

1. Radio and television receiver use this type of power supply.
2. It is also used in DVD player.
3. AC to DC power supply is used in all type of amplifiers.

4.1.2 DC to DC Converter

It is a device which converts a source of direct current (DC) from one voltage level to another.

Application

It is used in cellular phones and laptop computers.

4.1.3 DC to AC inverter

It is a device which converts a source of direct current into alternative current. Solar cell inverter is also perform similar function.

Application

An uninterruptible power supply uses an inverter to supply AC power when the main power is not available.

Each has its own specific areas of application. Of the three, , AC to DC power supply is the most commonly used and the subject of this lesson.

4.2. POWER SUPPLY BASICS

The basic function of power supply is shown in Figure 4.1.

Transformer: Transformer is used to step down the AC supply voltage (220 V AC, 50 Hz) as per the requirement of the solid state electronic devices.

Rectifier

Rectifier is a device which converts the sinusoidal AC voltage into either positive or negative pulsating DC. It contains unwanted AC components also called ripple. Diodes rectify the signal.

Filter

Filter is a device which passes DC components and blocks AC components of the rectifier output. Resistor, capacitor and inductor (passive components) are used for this purpose.

Voltage Regulator

Regulator or stabilizer is a device that is used to maintain a constant DC output voltage. Zener diode is used as regulator.

4.3. SEMICONDUCTOR DIODE

Semiconductor diode (mostly silicon diode) is used as a rectifier element. It converts alternating current into direct current. Hence let we see the working of semiconductor diode.

A PN junction is known as a semi-conductor or crystal diode

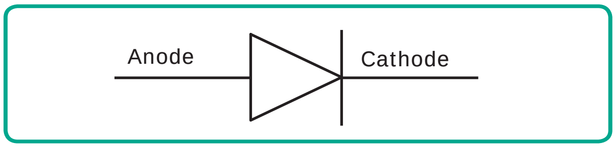


Figure 4.2 Symbol of diode

The character of a crystal diode is to conduct current in one direction only, permits it to be used as a rectifier. A crystal diode is usually represented by the schematic symbol shown in figure 4.2. The arrow in the symbol indicates the direction of conventional current flow.

The crystal diode has two terminals. When it is connected in a circuit, one thing to decide is whether the diode is forward or reverse biased. There is an easy rule to ascertain it. If the external circuit is trying to push the conventional current in the direction of arrow, the diode is forward biased. On the other

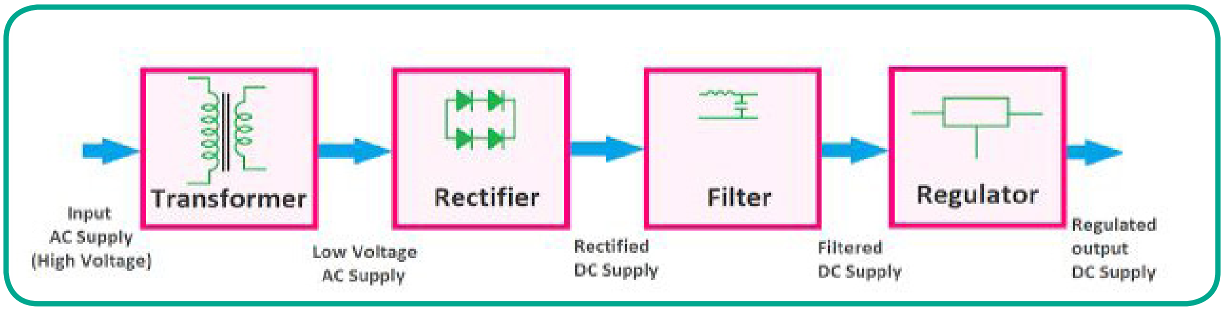


Figure 4.1 Basic power supply

hand, if the conventional current is trying to flow opposite to arrow head the diode is reverse biased. Putting in simple words:

1. If arrow head (i.e., Anode) of diode symbol is positive with respect to bar (i.e., Cathode) of the symbol the diode is forward biased.
2. If the arrow head (Anode) of diode symbol is negative with respect to bar(Cathode), the diode is reverse biased.

4.3.1 Forward Biasing

To apply forward bias, connect positive terminal of the battery to P-type and negative terminal to N-type as shown in Figure 4.3. Due to this, barrier potential is very much reduced. Positive terminal of the battery repels holes in P-side and negative terminal of the battery repels electrons in N-side. Because of this, current flows in the circuit. This is called "forward current". The magnitude of current depends upon the applied forward voltage.

> *"When external voltage applied to the junction is in such a direction that it cancels the potential barrier, thus permitting the current flow is called as forward biasing"*

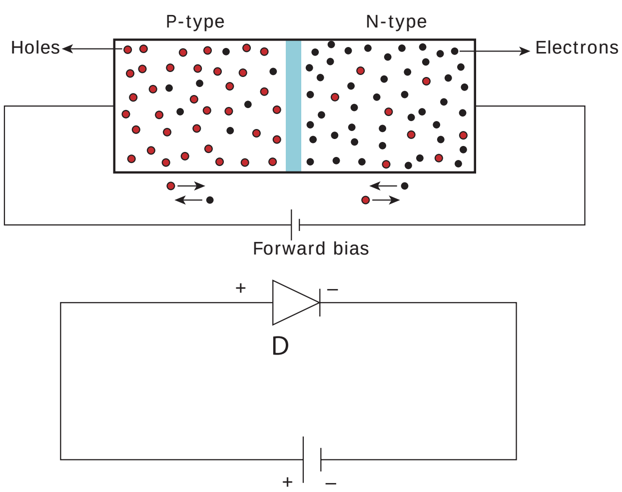


Figure 4.3 Forward Bias

The importent term often used with *pn* junction is knee voltage which is explained as follows.

4.3.2 Knee Voltage

> *"It is the forward voltage at which the current through the junction starts to increase rapidly"*

The figure 4.4 shows the characteristics of PN junction diode (forward bias).

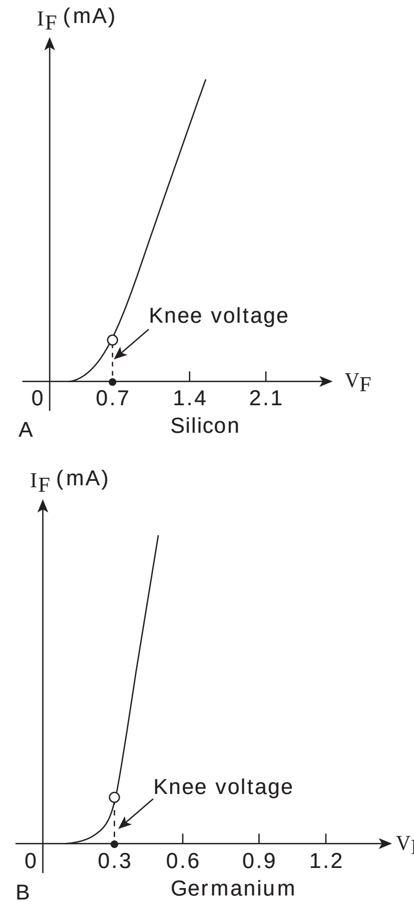


Figure 4.4 Characteristics of PN junction diode (Forward bias)

4.3.3 Reverse Biasing

> *"When the external voltage applied to the junction is in such a direction that potential barriers is increased, it is called reverse biasing"*

To apply reverse bias, connect negative terminal of the battery to P-type and positive terminal to N-type as shown in Figure 4.5. Because of increase in barrier potential the width of the depletion layer is also increased. As a result, the increased potential barrier prevents the flow of charge carriers (majority carriers) across the junction and hence the current does not flow.

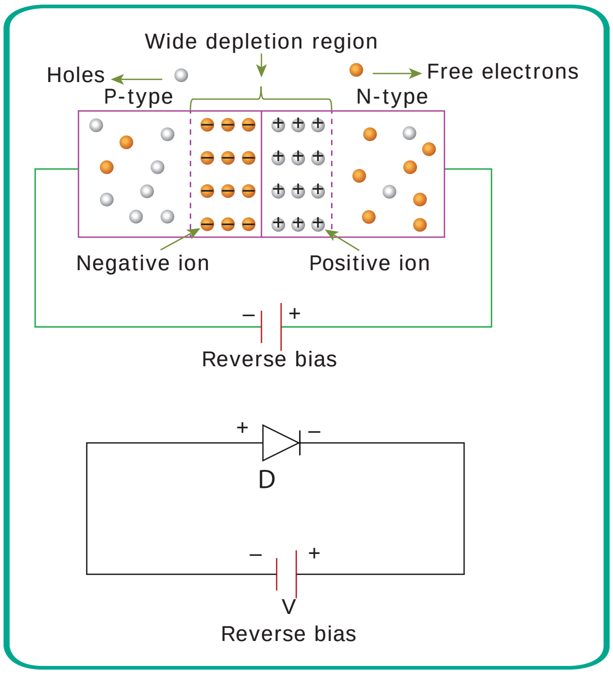


Figure 4.5 **Reverse bias**

From this, the students can understand the following:

1. *When pn junction is in forward biased condition, current flow occurs.*
2. *When pn junction is in reverse biased condition, no current flow occurs.*

The important term often used with *pn* junction is breakdown voltage which is explained as follows:

4.3.4 Breakdown voltage

"It is the minimum reverse voltage at which PN junction breakdown with sudden rise in reverse current".

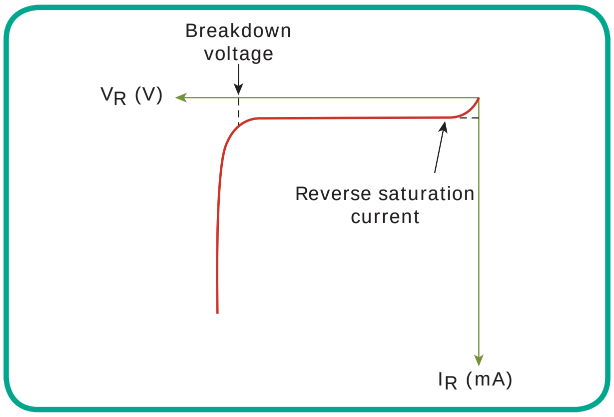


Figure 4.6 **Characteristics of PN junction diode (Reverse bias)**

The figure 4.6 shows the Characteristics of PN junction diode (Reverse bias)

4.4 RECTIFIERS

Rectifier is a device which converts the sinusoidal AC voltage into either postive or negative pulsating DC

4.4.1 Types of rectifier

There are few types of rectifier given in Figure 4.7.

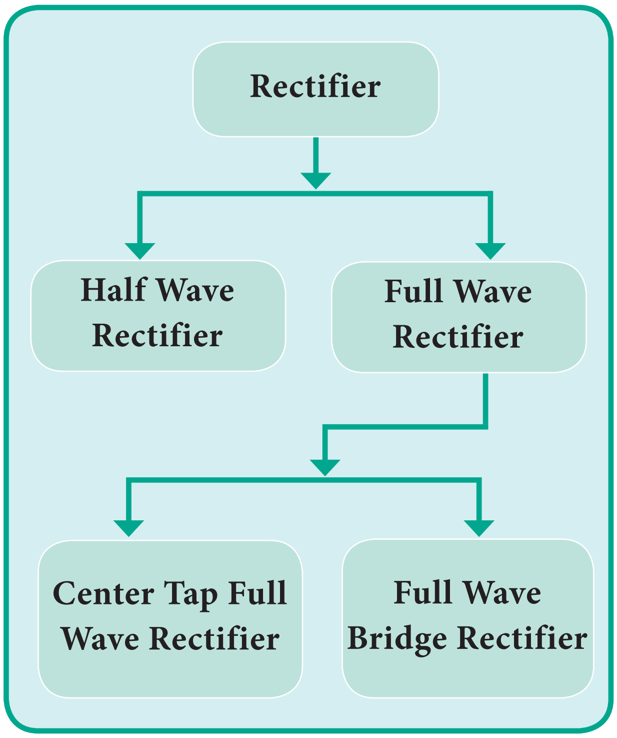


Figure 4.7 **Type of Rectifiers**

4.4.2 Half-wave Rectifier

This rectifier converts an AC input voltage into pulsating DC voltage for only one half cycle of the applied voltage. The circuit diagram of the half wave rectifier is shown in Figure 4.8(a).

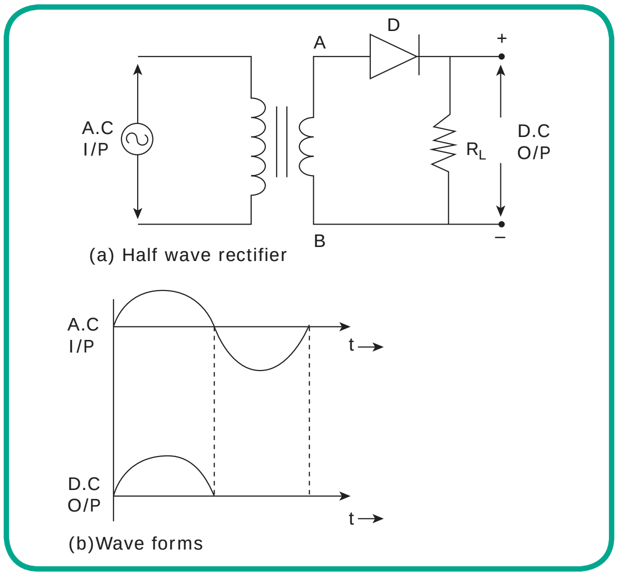


Figure 4.8 Half-wave Rectifier

During the positive half cycle, when the secondary winding of the upper end (A) is positive with respects to the lower end (B), the diode 'D' is under forward bias condition and it conducts current, this Current appears across the load R_L.

During the negative half cycle when the lower-end (B) winding of the secondary is positive with respect to the upper-end (A), the diode D is under reverse-bias condition

> The output voltage of a half-wave rectifier is calculated using the relationship $\frac{E_{max}}{\pi}$
>
> Where E_{max} is the maximum voltage of the input and π is the phase angle (180°)
>
> $$Ripple\ factor = f\ X\ 1$$
>
> Where f is the frequency.
>
> $$Efficiency = 40.6\%$$

and it does not conduct current. Hence the current across the load resistance is zero and so no power is delivered during the negative half-cycle. Thus the diode D conduct only one cycle (positive (or) negative) of the AC input so it is called as half wave rectifier.

Figure 4.8(b) shows the output wave forms of half wave rectifier

4.4.3 Full-wave Bridge Rectifier

As the centre-tapped transformer is expensive and is difficult to implement, bridge rectifier was developed. In this, four diodes are arranged in the form of a bridge-configuration to produce the desired output. Bridge rectifier are most widely used in high voltage applications. Bridge rectifiers are most widely used in high voltage applications. Figure 4.9 shows the full wave bridge rectifier circuit.

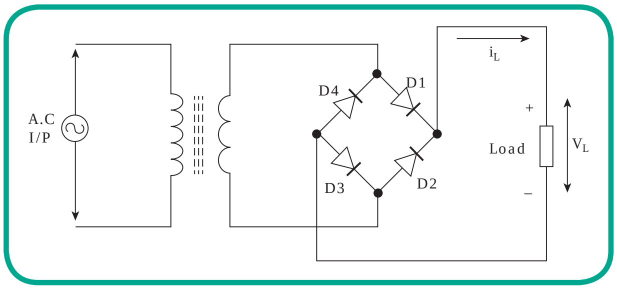


Figure 4.9 Full-wave bridge rectifier circuit

The four diodes labeled D_1, D_2, D_3 and D_4 are arranged in series pairs with only two diodes conducting current during each half-cycle.

During the positive half cycle of the supply, diodes D_1 and D_3 are under forward bias condition and these diodes conduct current and across the load R_L while D_2 and D_4 are reverse-biased and these diodes those not conduct current.

During the negative half cycle of the supply, diodes D_2 and D_4 are under forward bias condition and these diodes conduct current and across the load R_L while D_1 and D_3 are reverse-biased and these diodes does not conduct current.

The bridge rectifier is also called the full wave rectifier as it produces an output pulse for each half-cycle of the input sine wave. The input and output waveforms are shown in figure 4.10.

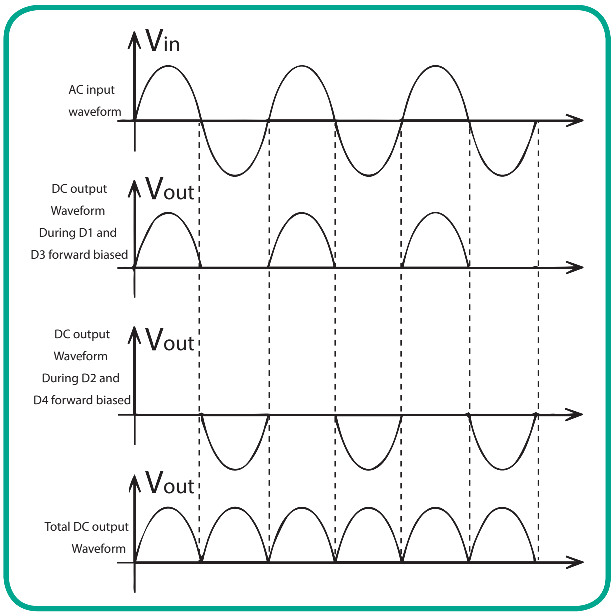


Figure 4.10 Input and output waveforms of bridge rectifier

$$\textit{Output of the full wave rectifier} = \frac{2E_{max}}{\pi}$$

$$\therefore \textit{ The Average DC Voltage } = 0.637\,E_{max}$$

$$\textit{Ripple Factors} = 2 \times f$$

$$\textit{Efficiency} = 81.2\%$$

4.5 FILTER CIRCUITS

To remove the AC components or filter-out them in a rectifier circuit, a filter circuit is used. A filter circuit is a device to remove the AC components of the rectifier output (pulsating DC – it is also called ripples), but allows the DC components to reach the load.

A filter circuit consists of passive elements, i.e., inductors, capacitors, resistors and their combinations. Some of the important filters are given below.

1. Inductor or Choke filter
2. Capacitor filter
3. RC filter
4. Inductor-Capacitor filter (LC filter)
5. π filter or CLC filter

4.5.1 CLC Filter or π Filter

Figure 4.11 shows the CLC filter circuit. It consists of one inductor and two capacitor connected across its each end. The three components are arranged in shape of Greek letter pie (π). The input capacitor C_1 is selected to offer very low reactance to the respective frequency, hence major parts of filtering is done by C_1. Most of the remaining ripples are removed by the combining action of L and C_2. This filter is used for the low current equipment.

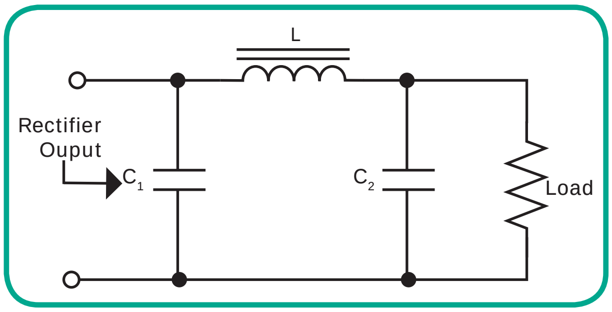


Figure 4.11 CLC (or) Pi Filter

4.6 VOLTAGE REGULATOR

Voltage Regulator is used to maintain a constant DC output voltage Zener diode is used as voltage regulator.

"A properly doped crystal diode which has a sharp breakdown voltage is known as a zener diode."

It may be seen that it is just like an ordinary diode except that the bar is turned into z-shape.

The figure 4.12(a) shows the symbol of Zener diode. Figure 4.12(b) shows the characteristics of Zener diode. The breakdown or zener voltage depends upon the amount of doping. If the diode is heavily doped, depletion layer will be thin and consequently the breakdown of the junction will occur at a lower reverse voltage. On the other hand, a lightly doped diode has a higher breakdown voltage.

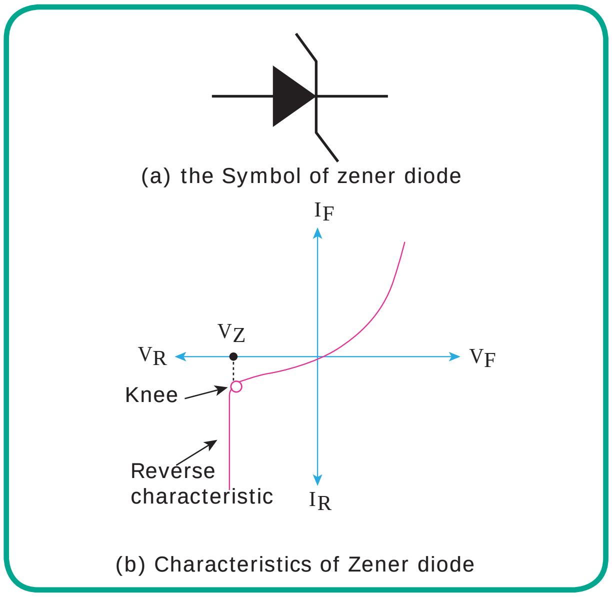


Figure 4.12 Symbol and characteristics of zener diode

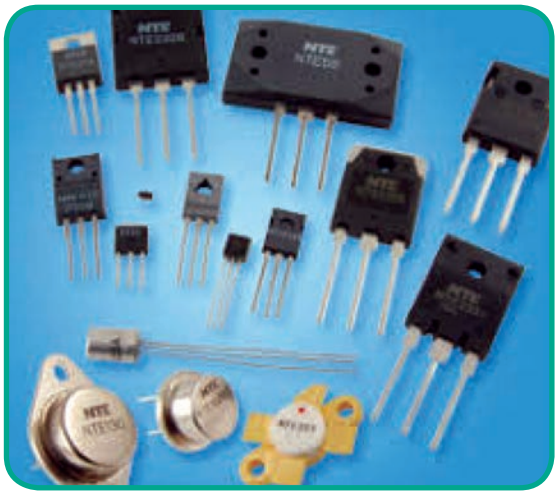
The following points may be noted about the zener diode:

1. A zener diode is like an ordinary diode except that it is properly doped so as to have a sharp breakdown voltage
2. A zener diode is always reverse connected i.e. it is always reverse biased.
3. A zener diode has sharp breakdown voltage, called zener voltage V_Z.
4. When forward biased, its characteristics are just those of ordinary diode.
5. The zener diode is not immediately burnt just because it has entered the breakdown region. As long as the external circuit connected to the diode current to less than burn out value, the diode will not burn out.

4.7. TRANSISTOR

It is made up of semiconductor material such as Si and Ge. Usually, it comprises of three terminals namely, base, emitter and collector for providing connection to the external circuit. Today, some transistors are packaged individually and many transistors are fabricated according to the design of an embedded integrated circuits.

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power.



Types of Transistors

Types of transistors

1. Bipolar Junction Transistor (BJT)
2. Field Effect Transistor (FET)

Bipolar Junction Transistor

Bipolar junction transistors consists of three semiconductor regions namely Base, Emitter, Collector forming two junctions. It is a current controlled device. There are two types of BJT's

1. NPN Transistor
2. PNP Transistor

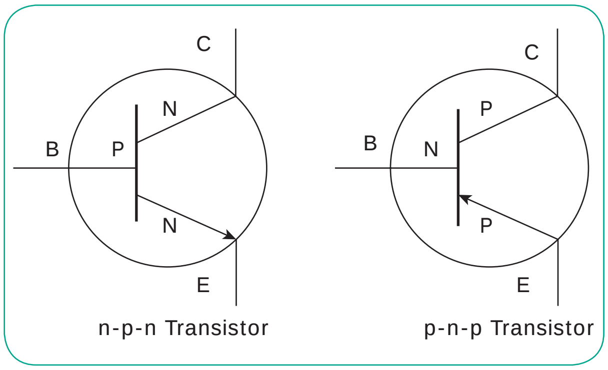


Figure 4.13 NPN and PNP Transistors

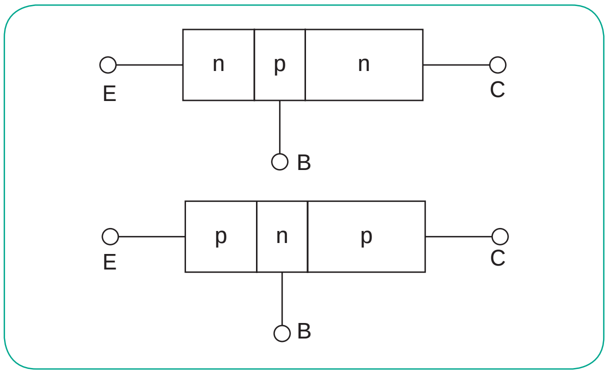


Figure 4.14 NPN and PNP Transistor

Figures 4.13 and 4.14 show the symbol and structure of NPN and PNP transistor, respectively.

SMD Transistor

A SMD transistor is a type of transistor that is directly soldered on the copper points in the surface of printed circuit board.

Advantage of SMD Transistor

1. There is no need to make holes in printed circuit board.
2. Smaller in size.

4.8. SOME FACTS ABOUT THE TRANSISTOR

1. The transistor has three regions, namely emitter, base and collector.
2. The base is much thinner than the emitter while collector is wider than both.
3. Usually the emitter is heavily doped, the base is lightly doped and very thin and the collector is moderately doped to collect majority carriers from the emitter
4. As the emitter is heavily doped, it can inject large number of charge carriers (electrons or holes) into the base.
5. The transistor has two PN junctions termed as the base-emitter junction and the base-collector junction.
6. In order to operate the transistor properly the two junctions must have the correct DC bias voltages.
7. Base-emitter junction is forward biased whereas base-collector junction is reverse biased.
8. The resistance of first junction is very small compared with the second junction. So, forward bias voltage applied to the first junction is very small compared to the second junction.

4.9. TRANSISTORS BIASING

Transistor biasing is the process of setting a transistor DC operating voltage or current condition to the required level. So that, any AC input signal can be amplified correctly by the transistor.

Various methods of transistor biasing

1. Fixed bias.
2. Feedback bias.
3. Voltage divider bias.

Of these three biasing, voltage divider biasing is most commonly used.

4.9.1 Voltage Divider Bias

This is the most commonly used biasing arrangement, as it provides good bias stability. The emitter resistance R_E provides stabilization. The resistance R_E causes a voltage drop in a direction so as to reverse bias the emitter junction. Since the emitter base junction has to be forward biased, the base voltage is obtained from the supply through R_1-R_2 network. The net forward bias across the emitter base junction is equal to V_B–DC voltage drop across R_E. The DC bias circuit is independent of transistors β to avoid the loss of AC signal. A capacitor having large capacitance is connected across R_E to bypass the unwanted AC fluctuations. Figure 4.15 shows voltage divider method of a transistor.

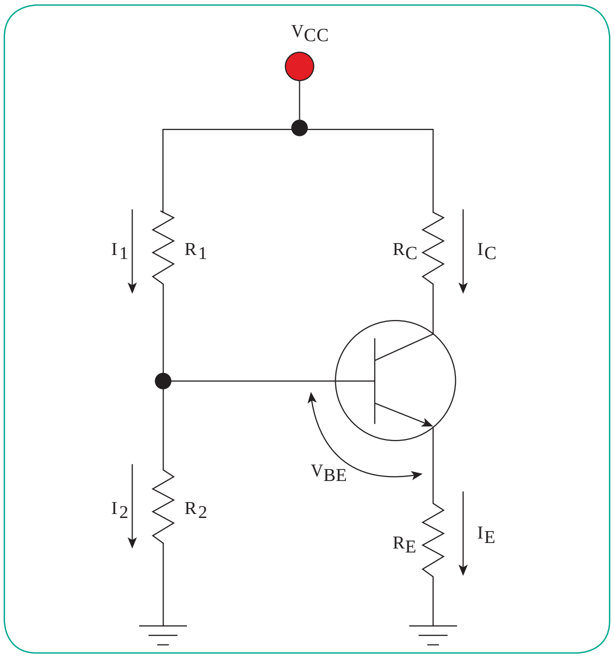


Figure 4.15 Voltage divider bias

4.10 OPERATING MODES OF TRANSISTORS

Depending on the biasing conditions like forward or reverse, BJT's have three major modes of operation namely, active, saturation and cut-off regions.

Active Mode : When Emitter Base junction is forward biased and Collector Base junction is reverse biased then the transistor reaches active mode. Here the transistor acts as an amplifier. In this mode emitter current depends on base current.

Saturation Mode: When both Emitter Base junction and Collector Base junction are forward biased the transistor reaches saturation mode. Here the transistor is " Fully ON " and operating as a closed switch. In this mode both base current and collector are high. Collector current will not depend on base current.

Cutoff Mode: When both Emitter Base junction and Collector Base junction are reverse biased, then the transistor reaches cutoff mode. Here the transistor is " Fully OFF " and operating as an open switch. In this mode base current and collector is zero.

4.11 WORKING OF NPN TRANSISTOR

4.11.1 Working of NPN transistor

Figure 4.16 shows the NPN transistor with forward bias to the emitter-base junction and reverse bias to collector-base junction.

The forward bias causes the electrons in the N-type emitter to flow towards the base. This constitute the emitter current I_E.

As these electrons flow through the p-type base, they tend to combine with holes.

As the base is lightly doped and very thin, only a few electrons (less than 5%) combine with holes to constitute base current I_B. The reminder electrons (more than 95%) cross-over into the collector region to constitute collector current I_C.

In this way, almost the entire emitter current flows to the collector circuit. It is clear that emitter current is the sum of collector and base current, i.e. $I_E = I_B + I_C$.

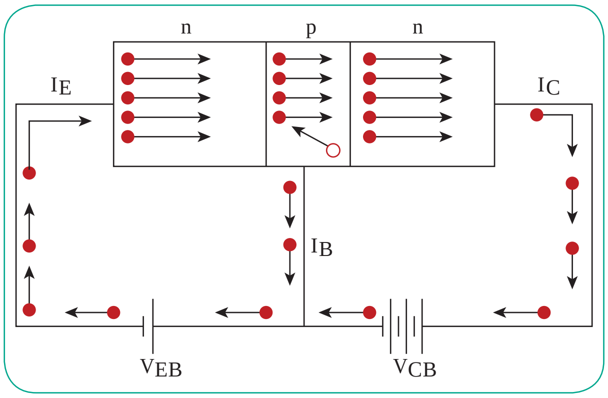


Figure 4.16 Working of NPN transistor

4.12 TRANSISTOR AS A SWITCH

With a zero signal applied to the base of the transistor, it turns OFF acting like an open switch and zero collector current flows through the device.

With a positive signal applied to the base of the transistor, it turns ON acting like a closed switch and maximum circuit current flows through the device.

Figure 4.17 shows how a transistor act as a switch.

4.13 TRANSISTOR AS AN AMPLIFIER

We can use a transistor as an amplifier for increasing the strength of the weak signal. With the help of circuit diagram, we explain how a transistor acts as an amplifier.

Figure 4.18 shows the basic circuit of a transistor amplifier. The weak signal to be amplified is applied as the input signal between the emitter-base junction and the output is taken across the load R_L. For faithful amplification, the input circuit is forward biased and the output circuit is reverse biased. For this purpose, we apply dc voltage.

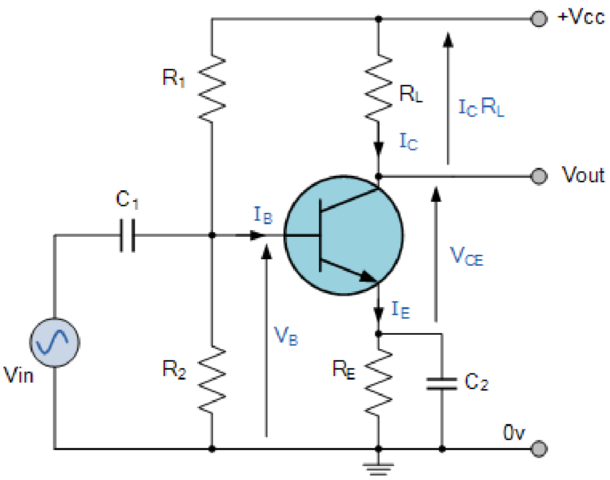


Figure 4.18 Basic Circuit of a transistor amplifier

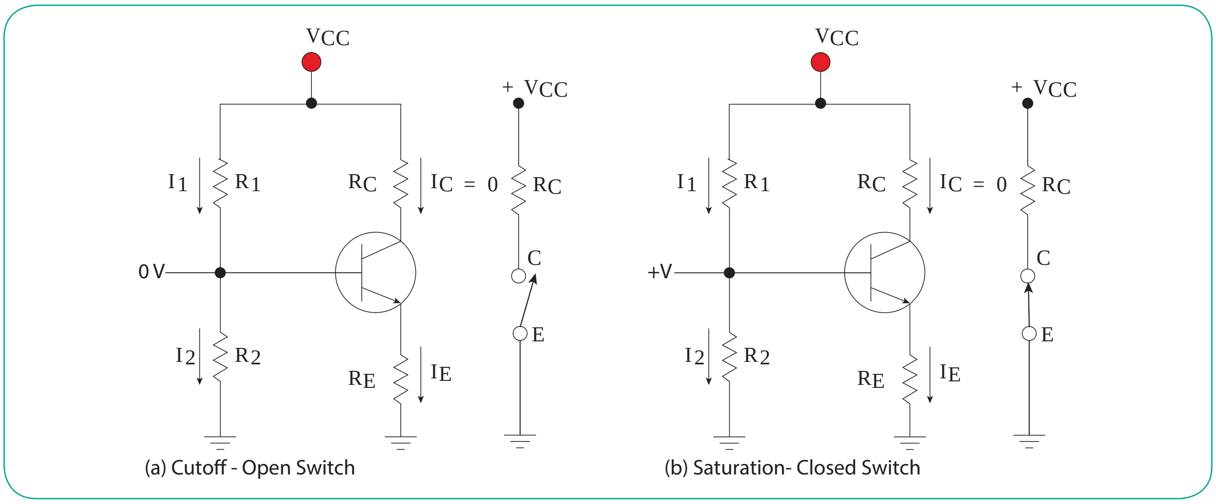


Figure 4.17 Transistor as a switch

As we know, the input circuit has low resistance; consequently, a small change in the signal voltage occurs at the input circuit lead to an appreciable change in the emitter current. Due to the transistor action, change in emitter current causes a similar change in the collector current. Now, the collector current flows through a high load resistance R_L, which produces a large voltage across R_L.

Thus, the weak signal applied in the input circuit appears in the amplified form in the collector circuit. In this way, transistor acts as an amplifier. For power amplification, heat sinks are used to fix the transistor in order to dissipate the heat generated from the power transistor.

Heat Sink

A metal plate specially designed to conduct and radiate heat from an electronic component. A layer of material place within the outer skin of high-speed aircraft to absorb heat.

4.14. TRANSISTOR CONFIGURATIONS & CLASSIFICATION OF AMPLIFIERS

A transistor is a three terminal device, (i.e., base, emitter, collector). But it require four terminals for connecting it in circuits.

(i.e.) Two terminals for input, two terminals for output.

Hence one of the terminal is made common to the input and output circuits. Common terminal is grounded.

Types of Configuration

Three types of configuration is available

1. *Common Base configuration (CB)*
2. *Common Emitter configuration(CE)*
3. *Common Collector configuration(CC)*

Among the above the Common Emitter configuration is essential. Hence let we see about it

Common Emitter Configuration

Common emitter configuration is shown in the figure 4.19. In this circuit emitter is placed common to both input and output terminals.

It has both current gain and voltage gain. So it is the most widely used circuit in all transistor applications.

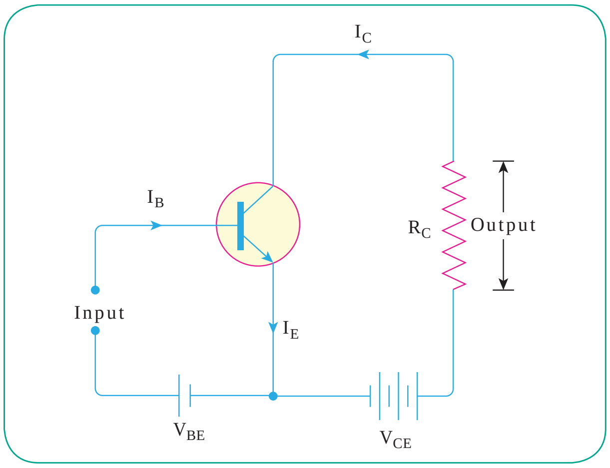


Figure 4.19 Common Emitter configuration

Classification of Transistor amplifiers.

Depending upon the configuration

1. Common base amplifier
2. Common emitter amplifier
3. Common collector amplifier

Depending upon the operations

1. Class A amplifier
2. Class B amplifier
3. Class AB amplifier
4. Class C amplifier

Based on the frequency

1. Radio frequency amplifier
2. Intermediate frequency amplifier

3. Audio frequency amplifier
4. Ultrasonic amplifier
5. Wide band amplifier
6. Video frequency amplifier
7. Buffer amplifier
8. Operational amplifier

Depending upon the property of their output

1. Voltage amplifier
2. Current amplifier
3. Power amplifier

Depending upon the coupling

1. RC coupled amplifier
2. Direct coupled amplifier
3. Transformer coupled amplifier

Here we study about few amplifiers

1. RC Coupled Amplifier

This is the most popular type of coupled amplifier because it is cheap and provides excellent audio fidelity over a wide range of frequency. It is usually employed for voltage amplification.

Figure 4.20 shows two stages of an RC coupled amplifier. A coupling capacitor C_C is used to connect the output of first-stage to the base (i.e. input) of the second-stage and so on. As the coupling from one stage to next is achieved by a coupling capacitor followed by a connection to a shunt resistor, therefore, such amplifiers are called resistance-capacitance coupled amplifiers.

Operation: When an AC signal is applied to the base of the first transistors, it appears in the amplified form across its collector load R_C. Then, the amplified signal is given to the base of next stage through coupling capacitor C_C. The second stage does further amplification of the signal. In this way, the cascaded (one after another) stages amplify the signal and the overall gain is considerably increased.

Application

RC coupled amplifiers are used in

1. RF Communication
2. Voltage amplifiers
3. Public Address System as pre amplifiers.
4. Small signal amplifiers in Radio and Television Receivers.

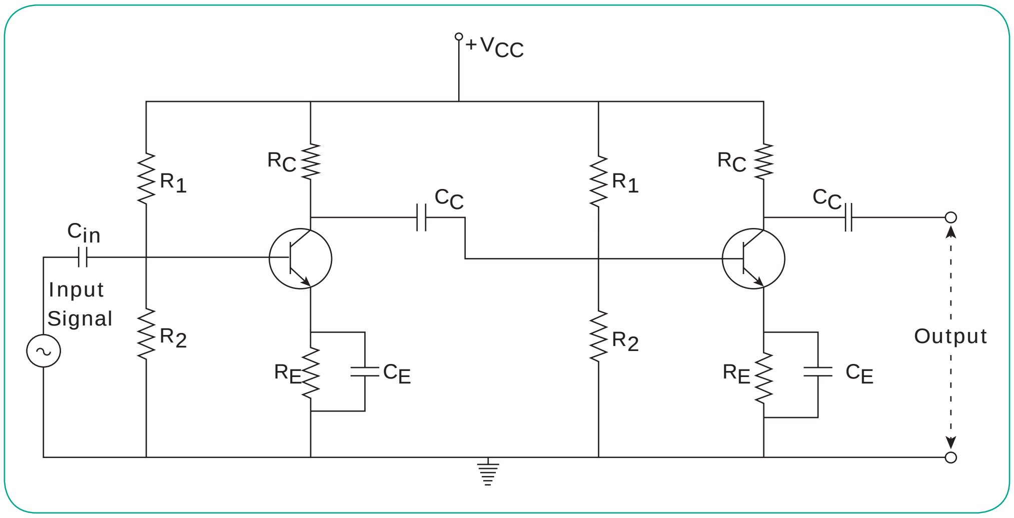


Figure 4.20 Stages of an RC coupled amplifier

2 Complementary Symmetry Amplifier

Complementary Symmetry is based on the principle of assembling a push-pull class B amplifier without requiring centre-tapped transformers, at the input and output stages.

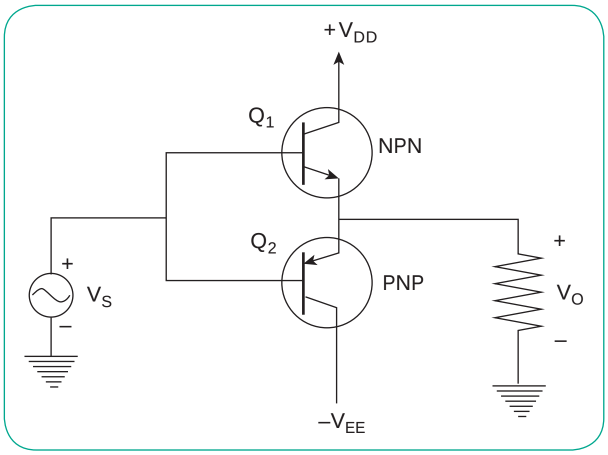


Figure 4.21 **Simplified complementary symmetry amplifier**

Figure 4.21 shows the transistor push-pull amplifier using complementary symmetry. It employs one NPN and one PNP transistor and requires no centre-tapped transformers. The circuit action is follows. During the positive half cycle of the input signal, transistor Q_1(the NPN transistor) conducts current while Q_2(the PNP transistor) is cut-off. During the negative half cycle of the input signal, transistor Q_2 (the PNP transistor) conducts current while Q_1 (the NPN transistor) is cut-off.

In this way, NPN transistor amplifies the positive half cycles of the signal while the PNP transistor amplifies the negative half cycles of the signal. Note that we generally use an output transformer (not centre tapped) for impedance matching.

Advantages

1. This circuit does not require transformer. It reduces both weight and cost.
2. Equal and opposite input signal voltages are not required.

Disadvantages

1. It is difficult to get a pair of transistors (NPN and PNP) having similar characteristics.
2. It requires both positive and negative supply voltages.

Application

This type of amplifier is used in

1. Stereo amplifiers.
2. Digital Switching designs.

4 Voltage Amplifier and Power Amplifier

Voltage Amplifier

Voltage amplifier improves the low voltage signal to a higher voltage one. The first stage of voltage amplifier is called pre-amplifier. The next stage of voltage amplifier is called driver amplifier. Figure 4.22 shows the Voltage amplifier used in audio circuits.

Power Amplifier

A power amplifier improves a low power signal to a higher power one. Two common examples are audio amplifiers and RF

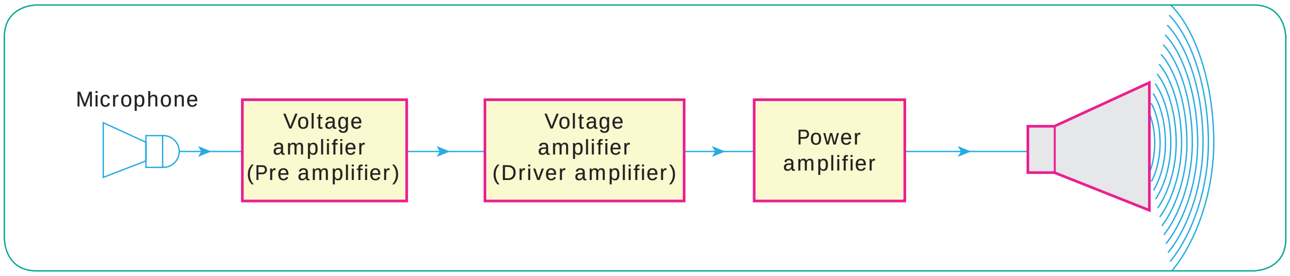


Figure 4.22 **Voltage Amplifier**

Table 4.1 Comparison of Voltage and Power Amplifier

S.NO	Basic for Comparison	Voltage amplifier	Power amplifier
1	Basic	It raises the voltage level	It raises the power level
2	Known as	Small signal amplifier	Large signal amplifier
3	Magnitude of input signal	Small	Comparatively large
4	Types of coupling used	RC Coupling	Transformer Coupling
5	Base region	Thin	Thick
6	Value of Ic	Low (around 1mA)	Quite high (Nearly 100mA)
7	Value of β	Low (5 to 20)	High (100)
8	Physical size of transistor	Small	Large
9	Heat dissipation	Less	More
10	Load Impedance	High (4 kΩ to 10 kΩ)	Low (5 to 20Ω)

power amplifiers. Audio amplifiers are used to drive loud speakers and head phones. RF power amplifiers are used in the final stage of transmitters.

Comparison between voltage and power amplifier is given in the Table 4.1.

4.15 FEED BACK IN AMPLIFIERS

The process of injecting a fraction of output energy back to the input is known as feedback

There are two basics types of feedback in amplifiers

1. Positive Feedback
2. Negative Feedback

4.16 DISTORTION IN AMPLIFIERS

The change in output wave-shape from the input wave-shape of an amplifier is known as distortion.

The distortion can be classified as follows

1. Amplitude distortion
2. Phase distortion
3. Frequency distortion

4.17 APPLICATIONS OF A TRANSISTOR

1. Transistors are used in digital and analog circuits as a switch.
2. Transistor uses in signal amplifier devices.
3. Transistors can be used for oscillator.
4. Cellular phones would be one of the most widely used applications of transistors. Every cell phone uses a transistor amplifier.
5. Transistor uses in power regulator and controllers.
6. Transistors are used in building some of the integrated circuits.(IC).
7. The microprocessor includes more than thousands of transistors in each chip.
8. In military, the transistor's are used in high-power radio frequency (RF) RADAR and walkie talkie.

LEARNING OUTCOMES

After studying this Chapter, a student can understand the following

1. **Need of power supply**
2. **Types of AC to DC supply**
3. **Efficiency of power conversion**
4. **Power supply applications**
5. **Understanding transistor configurations.**
6. **Analysing the transistor applications.**

GLOSSARY

S. No	Terms	Explanation
1	**Step down transformer**	Transformer in which the output AC voltage is less than the input AC voltage
2	**Rectification**	Process that converts alternating current to direct current
3	**Regulator**	Device or circuit that maintains a desired output under changing conditions
4	**Ripple voltage**	The small variation in DC voltage that remains after filtering in a Power supply
5	**Filter**	Network consisting of capacitors, resistors and inductors used to pass certain frequencies and block others

QUESTIONS

PART A

I. Choose the Best Answer

1. The output of a rectifier is
   a) Pulsating DC b) Pure DC
   c) Pure AC d) None of the above
2. In a full wave bridge rectifier, if AC supply is 50 Hz then AC ripple in the output is
   a) 50 Hz b) 100 Hz
   c) 25 Hz d) 200 Hz
3. For high voltage applications, we use
   a) Center tap rectifier
   b) Bridge rectifier
   c) Half-wave rectifier
   d) None of the above
4. In filter circuits, we generally use .... capacitors.
   a) Mica b) Paper
   c) Air d) Electrolytic
5. The maximum rectification efficiency in full wave bridge rectifier is
   a) 100% b) 81.2%
   c) 66.6% d) 40.6%
6. The number of depletion layers in a transistor is ....
   a) Four
   b) Three
   c) One
   d) Two

7 A transistor is a ……….. operated device.

a) Current
b) Voltage
c) Both voltage and current
d) None of the above

8. A heat sink is generally used with a transistor to …………

a) Increase the forward current
b) Decrease the forward current
c) Compensate for excessive doping
d) Prevent excess temperature

9. A complementary symmetry amplifier has

a) 1 PNP & 1 NPN transistor
b) 2 PNP transistor
c) 2 NPN transistor
d) 2 P channel FETS

10. The most commonly used transistor arrangement is ………….

a) Common emitter
b) Common base
c) Common collector
d) None of the above

PART B

II. Answer in few sentences 3 Marks

1. What are the types of power conversion?
2. What is rectification?
3. Give the uses of filter circuits.
4. What is meant by a transistor?
5. Give the symbol of PNP and NPN transistor
6. Define an amplifier
7. What are the diffirent modes of transistor?
8. Define feedback
9. What is distortion?
10. Write down the types of distortion occurs in amplifier.

PART C

III. Answer the following Questions.

5 Marks

1. Draw the block diagram of power supply unit and explain each block.
2. Explain half-wave rectifier with circuit diagram.
3. Explain the working principles of NPN transistor
4. Compare voltage amplifiers and power amplifiers.
5. What are the applications of transistor?

PART D

IV. Answer the following Questions.

10 Marks

1. Draw the circuit diagram of bridge rectifier and explain its working function.
2. Explain how transistor works as an amplifier.
3. Explain the working principle of RC coupled amplifier.

Answer Key

1. (a) 2. (b) 3. (b) 4. (d) 5. (b)

6. (b) 7. (c) 8. (d) 9. (a) 10. (a)