# IDEAL SCHOOL OF ENGINEERING
## RETANG, BHUBANESWAR

# BASIC ELECTRONICS ENGINEERING (TH-4.b)

1st Semester (Diploma Course)
(As per the syllabus prepared by the SCTE&VT, Bhubaneswar, Odisha)


**Prepared By:**

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# BASIC ELECTRONIC ENGINEERING

## CHAPTER-WISE DISTRIBUTION OF PERIODS & MARKS

| Sl. No. | Chapter No. | Topics | Periods as per syllabus | Periods actually needed | Expected marks |
|---|---|---|---|---|---|
| 01 | 01 | Electronic Devices | **08** | **07** | **08** |
| 02 | 02 | Electronic Circuits | **09** | **10** | **12** |
| 03 | 03 | Communication System | **03** | **04** | **10** |
| 04 | 04 | Transducers And Measuring Instruments | **10** | **10** | **18** |
| **Total** | | | **30** | **31** | **48** |

# CHAPTER-1
# ELECTRONIC DEVICE

***LEARING OBJECTIVES:***

*1.1 Basic Concept of Electronics and its application.*
*1.2 Basic Concept of Electron Emission & its types.*
*1.3 Classification of material according to electrical conductivity (Conductor, Semiconductor & Insulator) with respect to energy band diagram only.*
*1.4 Difference between Intrinsic & Extrinsic Semiconductor.*
*1.5 Difference between vacuum tube & semiconductor.*
*1.6 Principle of working and use of PN junction diode, Zener diode and Light Emitting Diode (LED)*
*1.7 Integrated circuits (I.C) & its advantages.*

## 1.1 Basic concept of electronics and its Application:

**ELECTRONICS-**

• It is branch of engineering which deals with the current conduction through vacuum tubes, semiconductor or gases.

**Application of electronics: -**

- Rectification
- Amplification
- Conversion of light to electricity
- Conversion of electricity to light

**Fundamentals of electronics: -**

**Valence cell: -**

• The outer most cell of an atom is known as valence cell.

**Electron: -**

• It is one of the most fundamental particles of an atom having a -ve charge.

**Valence Electron**

The electron present in the outer most orbit is known as valence electron.

**Free electron: -**

→ The valence electron which are loosely attracted by the nucleus is called as free electron.

→ The free electrons are responsible for current conduction.

## 1.2 Basic concept of Electron emission & its Types: -

→ The liberation of electron from the surface of a metal is known as electronemission.

## Work function: -

→ The amount of additional energy required to emit an electron from a metallic surface is known as work function of that metal.

## Types of electronic emission: -

→ There are 4 types of electron emission

1. Thermionic emission
2. Field emission
3. Photo electric emission
4. Secondary emission

## 1. Thermionic emission: -

→ The processes of emitting of electron from the surface of metal by applying heat energy is known as thermionic emission.

## 2. Field emission: -

→ The processes of emitting of electron from the surface of metal by applying strong electric field is known as field emission.

## 3. Photo electric emission: -

→ The processes of emitting of electron from the surface of metal by applying light energy is known as photo electric emission.

## 4. Secondary emission: -

→ The process of electron emission by the application of bombardment of high-speed electron is known as secondary emission.

## Energy band: -

→ The range of energy occupied by an electron is known as energy band.

## Valence band: -

→ The range of energy occupied by valence electron is known as valence band.

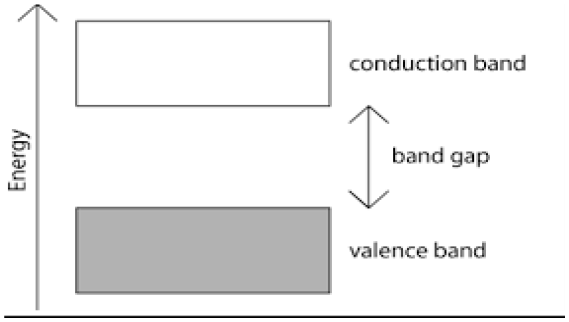
## Conduction band: -

→ The range of energy occupied by conduction electron is known as conduction band.

## Forbidden energy gap: -

→ The gap between valence band and conduction band in the energy band diagram is known as forbidden energy gap.

→ Its unit is ev (Electron Volt)

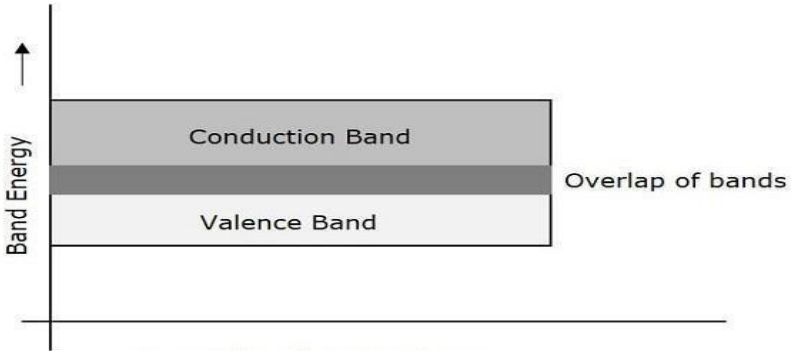



## 1.3 Classification of material according to electrical conductivity (Conductor, Semiconductor & Insulator) with respect to energy band diagram only: -

- According to electrical conductivity solid can be classified in 3 types.
    1. Conductor
    2. Insulator
    3. Semi-conductor

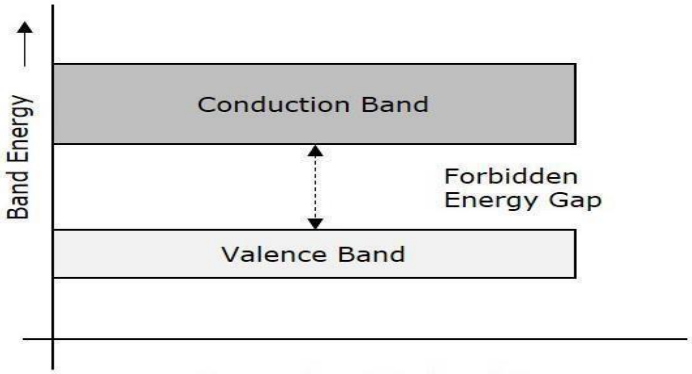
### 1. Conductor: -

→ The materials through which electricity can passed easily are known as conductor.
→ The energy band diagram can be shown as below.
→ The conduction band and valence band are overlap with each other.
→ Ex-Iron, Gold, Copper etc.




### 2. Insulator: -

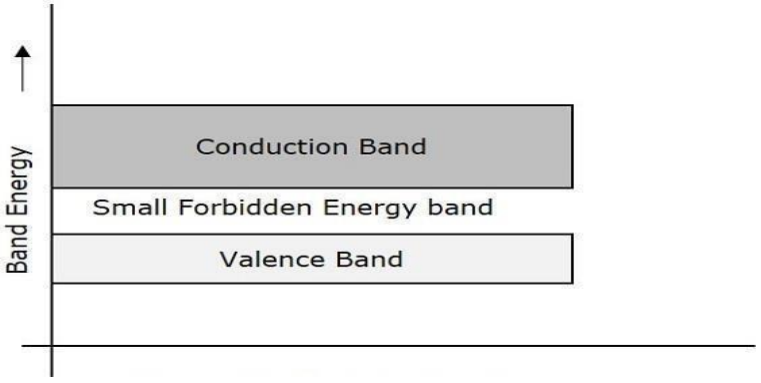
→ The materials through which no electricity can passed is known as insulator.
→ The energy band diagram can be shown as below.
→ The forbidden energy gap is nearly equal to 15 ev.
→ Ex-Wood, Rubber, Glass etc.



### 3. Semi-conductor: -

→ The materials whose electrical conductivity lies in between conductor and insulator are known as semiconductor.

→ The energy band diagram can be shown as below.




→ The forbidden energy gap(fg) in case of semiconductor is 1.1 ev.

### Semiconductor: -

Doping: -

- The process of adding impurity in pure form of semiconductor is known as doping.Impurity itself called as dopant.
- According to electrical conductivity, semiconductor can be classified in 2types, such as Intrinsic semiconductor & extrinsic semiconductor

## 1.4 Discusses intrinsic semiconductor & extrinsic semiconductor:

### Intrinsic semiconductor:

- The pure form of semiconductor without any impurity is known as intrinsic semiconductor.

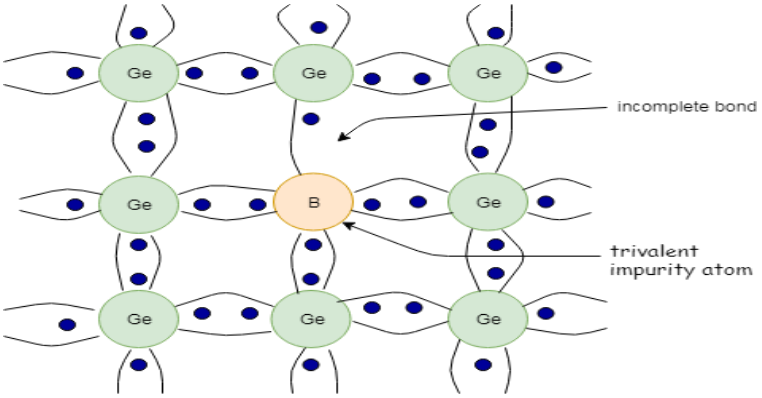
### Extrinsic semiconductor: -

- The impure form of semiconductor is known as extrinsic semiconductor.
- Extrinsic semiconductor again classified in to 2 types.
  1. P- type semiconductor
  2. N- type semiconductor

### 1. P type semiconductor: -

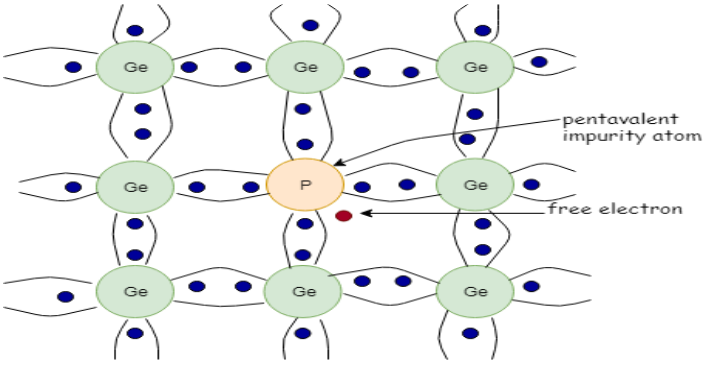
- The impure semiconductor is formed by adding trivalent impurity (Br, Al) is known asP type semiconductor.
- Since Br is a trivalent atom, so three electrons of Ge will form three co-valent bonds.
- But $4^{th}$ electron of Ge can't form any bond since the absence of another extra electron in Br.
- The absence of electron is known as **hole**. It is +ve charged.
- In P type semiconductor the **measurity** charge carrier are **holes** &

**minority** charge carriers are **electrons**.




## 2. N type semiconductor: -

- The impure form of semiconductor which is form by adding pentavalent impurity atom (A, P) is known as N type semiconductor.
- Here four valence electrons of Ge will form 4 covalent bonds with 4valence electrons of P.
- But P has 5 valences electrons.so one electron will remain as free.
- So, in N type semiconductor electrons are the majority charge carriers and holes are the minority charge carriers.




# 1.5 Difference between vacuum tube and semiconductor:-

## Vacuum Tube

- Large in size.
- Cost is high.
- More heat generation.
- Low efficiency.
- Less sensitive to temperature.

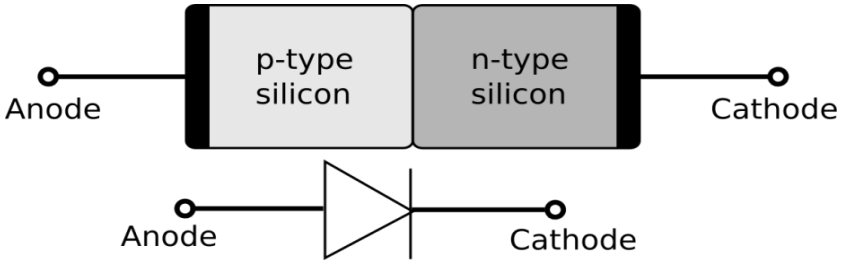
## Semiconductor

- Smaller in size.
- Cost is low.
- Less heat generation.
- High efficiency.
- High sensitive to temperature.

## 1.6 Working principle of P N junction diode, Zener Diode & LED:

### P N Junction: -

- When P type semiconductor is suitably joined with a N type semiconductor, then the contact surface is known as P N junction.
- One P N junction is known as semiconductor diode. It has two terminals,one is +ve other one is -ve.
- **SYMBOL: -**




### Depletion layer: -

- The layer in which uncovered ions are present is known as depletion layer.

### Potential barrier: -

- The voltage drop across the depletion layer is known as potential barrier.

The working principle of P N junction diode can be explained by followingtwo conditions.

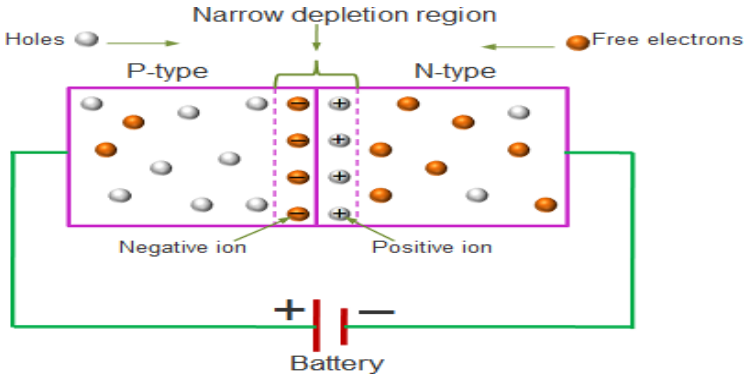
a. Forward biasing.
b. Reverse biasing.

### Biasing:

- Application of external voltage to the P N junction is known as biasing.

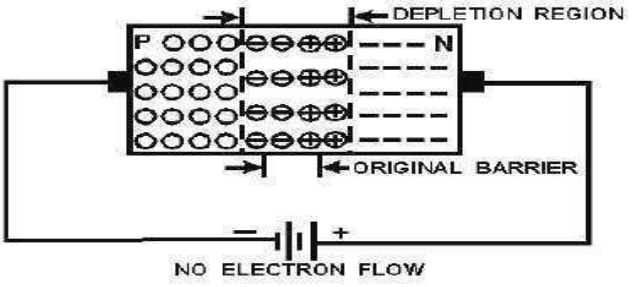
### Forward biasing: -

- When P type semiconductor is connected to the +ve terminals ofthe battery & N type semiconductor is connected to the -ve terminal of the battery then this is known as forward biasing.
- In case of forward biasing, since the voltage source is connected in the forward direction. So, the +ve terminal of the battery will repeal the holes present in the P type materials.
- Similarly, the -ve terminal of the battery will repeal the electrons present in the N type materials.
- As a result of which the electrons will starts moving in a path as shown infigure.
- In forward biasing case the resistance is very low.
- Since the depletion layer is negligible. So, the current conduction occurs in case of forward biasing.




## Reverse biasing: -

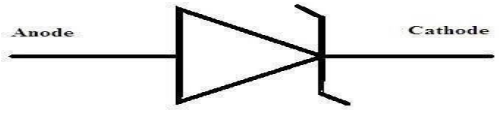
- When a P type semiconductor is connected to the -ve terminal of the battery & N type semiconductor is connected to the + ve terminal of thebattery than it is known as reverse biasing.
- Before the connection of voltage source there is a depletion layer which is marked as the original depletion layer.
- When the voltage source is connected in reverse biasing mode, then thedepletion layer increases. So, the barrier potential also increases.
- Due to the large barrier potential, no current flows across the junction.So, in reverse biasing no current flows.




# Conclusion: -

- From the above discussion we can conclude that current flows through a diode in forward biasing and in case of reverse biasing no current flows through a diode.

## ZENER DIODE: -




- A properly doped semiconductor diode with sharp break down voltage Is known as Zener Diode.
- When the voltage is increased in the reversed direction then a breakdownvoltage is appears, where the reverses current increased sharply.
- The breakdown voltage is called as Zener Voltage and the increased current is called Zener Current.
- The Zener Voltage depends upon the amount of doping. If the diode is heavily dope then depletion layer will be thin and lower breakdown voltage\Zener occurs. On the other hand, a lightly dope diode has a higher breakdown voltage.

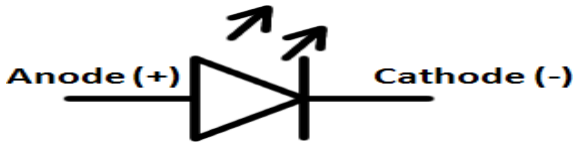
## APPLICATION OF ZENER DIODE: -

- Zener diodes are used as voltage regulator.

## LIGHT EMITTING DIODE(LED): -

- LED is a special type of PN junction diode which gives of visible light where forward biased.

## SYMBOL: -




## OPERATION OF LED: -

- LED is a special purpose diode which emits light when forward biased.
- LED cannot be operated in reverse biased condition.
- When it is forward biased the electrons move from N type to P type semiconductor.
- These electrons are re combines with holes then light energy will be generated.
- In this way LED gives up visible light.

## APPLICATION OF LED: -

- As a power indicator.
- 7 segments display etc.

# 1.7 Integrated circuits (IC) & Its Advantages:-

- An IC is a circuit in which the circuit components such as transistor, capacitor, resistor etc are automatically part of small semiconductor chip.

## Advantages of IC: -

- Reliable.
- Extremely small in size.
- Low cost.
- Small power consumption.

## Disadvantages of IC: -

- Cannot produce high power.
- Transformer & inductor cannot be fabricated.
- If any one of circuit component fails, then the hole IC will be replaced.

## USES: -

- Voltage regulator.
- IC 555 as multivibrator.
- Constant current source.

# POSSIBLE SHORT TYPE QUESTION WITH ANSWER:

## 1. Define electronics. [W-16,17,18; S-17]

Ans: -It is the branch of engineering which deals with the currentconduction through the vacuum tube, semiconductor or gas.

## 2. Define doping.

Ans: -The process of adding impurities to the pure form of semiconductor is known as doping.

- The impurity itself is called dopant.

## 3. What is a semiconductor? [

Ans: -The material whose electrical conductivity lies in between conductor andinsulator are known as semiconductor.

Ex-Ge, Si

## 4.Define electron emission. [W-18,20; S-19]

Ans: The liberation of electron from the surface of a metal is known as electron emission.

## 5.Write different types of electronic emission. [W-18,20; S-19]

Ans: - a) Thermionic emission.

b) Field emission.

c) Photo electric emission.

d)Secondary emission.

## 6.Define I C. [W-17]

Ans: -An I C is a circuit in which the circuit compounds such as transistor, diode, capacitor, resistor etc are automatically part of small semiconductor chip.

## 7.What is LED and give its two application?

Ans: -LED is a special type of PN junction diode which gives of visible light when forward biased.

- Its two applications are
  a) As a power indicator
  b) 7 segments display etc.

# POSSIBLE LONG TYPE QUESTION

1. Define Emission and explain various types of emission in details. [W-17,18,20; S-19]
2. Difference between semiconductor and vacuum tube.[W-18, S-18, 19]
3. Classify solids according two energy band diagrams. [W-17, 18,19; S-19]
4. Write short note on I C?
5. Explain working principle of P N junction diode.
   a) Write short notes on LED

# CHAPTER -2

# ELECTRONICS CIRCUIT

LEARNING OBJECTIVES

*2.1 –Define Rectifier & It's Uses*

*2.2 Principles Of Working Of Different Types Of Rectifier & Their Merit & Demerit*

*2.3- Function Of Filters & Classification simple Filter Characteristics (capacitor, choke& pie)*

*2.4 Dc Power Supply System with Help Of Block Diagram Only*

*2.5 Different Types Transistor Configuration & State Output & Input Current Gain relationship in CE, CB & CC configuration (no mathematical derivation)*

*2.6-Need of Biasing & Different Types Of Baising With Circuit Diagram (CE -Configuration)*

*2.7 Amplifiers concept, working principle of single Phase Rc Coupled Amplifier-*

*2.8 –Electronics Oscillator & It's Classification*

*2.9 – Working of basic oscillator with different elements through simple block diagram*

# 2.1 –DEFINE RECTIFIER & IT'S USES

Rectifier is an electronics device which convert alternating current to direct current

### Uses of rectifier-

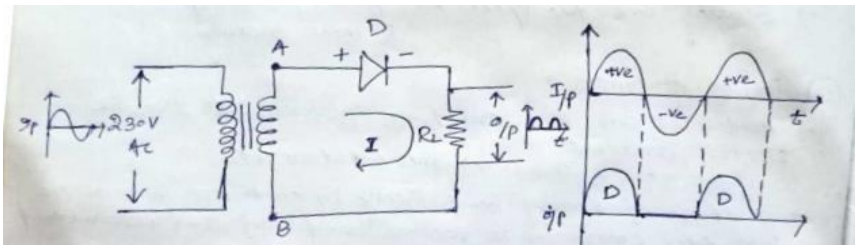
It is used in house hold accessories like laptop, radio ,tv, videogame

# 2.2 Principles of working of different types of rectifier & their merit & demerit

It devided into two types

- Half wave rectifier
- Full wave rectifier

### Half wave rectifier-




### Working principle- B

- During +ve half cycle of i/p AC voltage ,end A becomes +ve w.r.t to end B
- Under this condition the diode D is forward baised& hence it conduct current
- During -ve half cycle of i/p AC voltage ,end B becomes +ve w.r.t to end A
- Under this condition the diode D is reverse baised& hence it does not conduct current
- Therefore current flow through the diode during +ve half cycle & blocked in –ve half cycle

### Advantage of half wave rectifier-

- It is simple ckt
- It has low cost & we can easily construct
- It has less no of components so it is very cheap

## disadvantage of half wave rectifier-

- The pulsating current in the load contains AC components whose basic frequency is equal to the supply frequency
- It is low efficiency like 40.6%

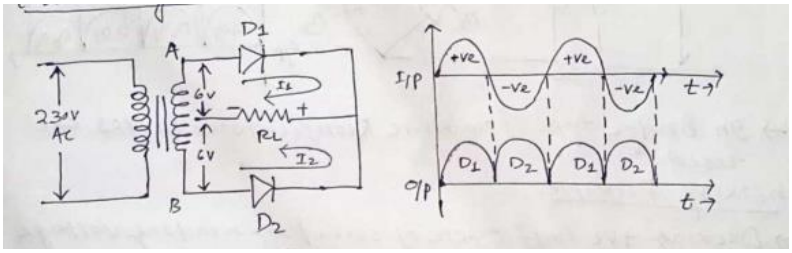
## Full wave rectifier-

It is two types

- Center tape fullwave rectifier
- Bridge type fullwave rectifier

## Center tape fullwave rectifier-

## Circuit Diagram




It contains two diodes

## Working principle-

- During +half cycle terminal A is +ve& terminal B is –ve .i.e diode $D_1$ is forward baised& it conduct current but $D_2$ is reversebaised so it does not conduct current.
- During -half cycle terminal A is +ve& terminal B is +ve .i.e diode $D_1$ isreverse baised& it does notconduct current but $D_2$ is forward baised so it conduct current.

## Advantage of center tape full wave rectifier-

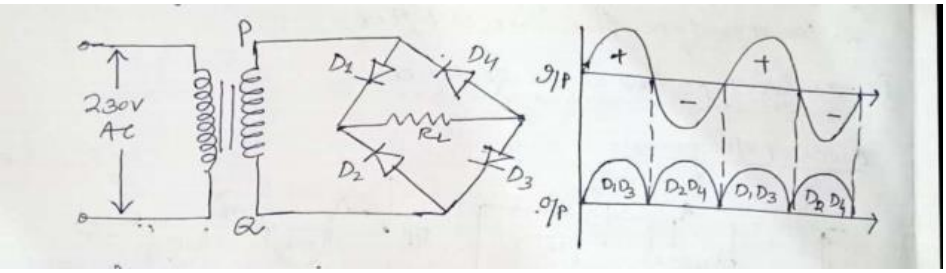
- It has efficiency twice of half wave rectifier
- So efficiency is 81.2%

## Disadvantage of center tape full wave rectifier

- It is expensive to manufacture center tape transformer ,in which produce equal voltage of each half of secondary winding

### Bridge rectifier-

### Circuit diagram-




-It contains four diodes

### Working principle-

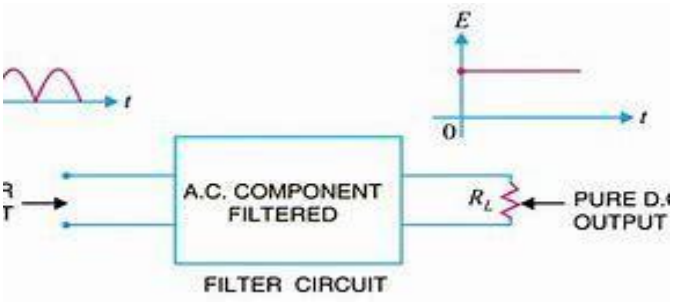
- During +ve half cycle of secondary winding voltage the terminal P of the secondary winding becomes +ve& Q becomes –ve
- So the diode $D_1$ &$D_3$ forward baised while $D_2$ &$D_4$ reverse baised ,so $D_1$ &$D_3$ are conduct current but $D_2$ &$D_4$ does not conduct current
- During -ve half cycle of secondary winding voltage the terminal P of the secondary winding becomes -ve& Q becomes –ve
- So the diode $D_1$ &$D_3$ reverse baised while $D_2$ &$D_4$ forward baised ,so $D_1$ &$D_3$ are not conduct current but $D_2$ &$D_4$ conduct current.

## 2.3- Function Of Filters & Classification simple Filter Characteristics(capacitor,choke& pie)

### Filter Circuit-

A filter is a device which removes the AC component of rectifier o/p & allow the pure DC to the load resistor

- This ckt generally combination of capacitor & inductor.




## Types of filter ckt-

(1) Capacitor filter
(2) Choke filter
(3) Pie π filter

## capacitor –

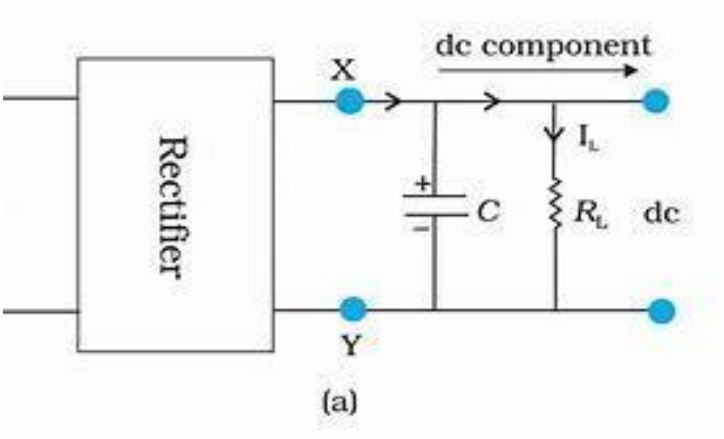
capacitor is a passive electronics components that store energy in the form of electrostatic field

- It consist of two conducting plates separated by an insulating materials called dielectrics
- Capacitor blocks the flow of DC components & allow the flow of AC components

## Capacitor Filter-

- It consist of capacitor (C) placed across the rectifier o/p in parallel with the load resistor

### Circuit diagram




- The pulsating direct voltage of the rectifier is applied across the capacitor

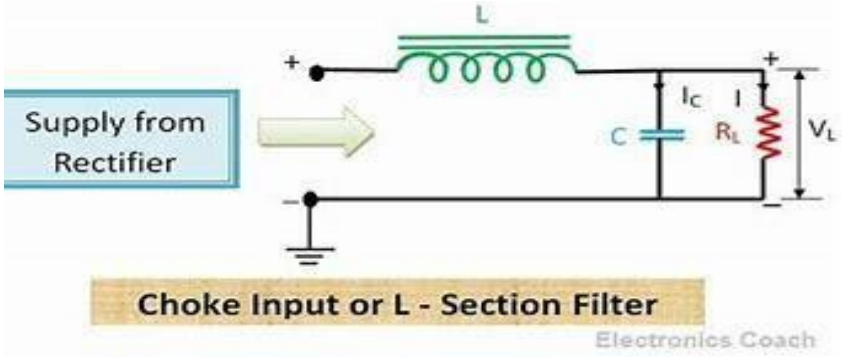
- As the rectifier voltage increases ,it changes the capacitor & also supplies current to the load
- At the end of the quarter cycle (point A) ,the capacitor is charged the pick voltage of capacitor voltage
- Now the rectifier voltage stats to decreased . the capacitor discharge through the load are an shown by the line (AB)
- Voltage across loads will decreased slightly because immidiatly the next voltage peak comes & recharge capacitor
- This process is repeated again & again and the o/p wave form becomes ABCDEF

## Advantages-

- The capacitor filter ckt is extremely popular because of it's low cost, small size, little weight & good characteristics
- It is commonly used in battery eliminator

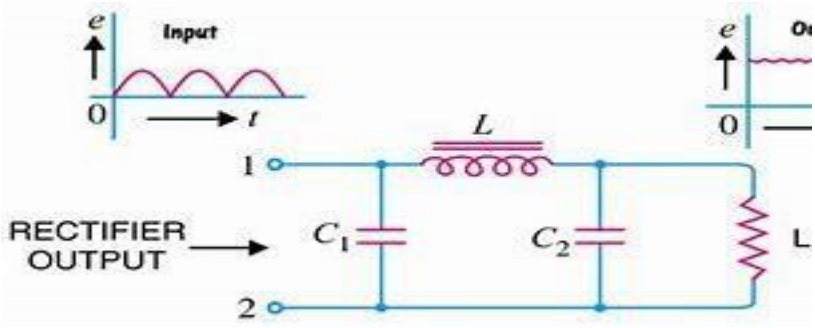
## Choke input filter-

- It consist of choke (L) connected in series with the rectifier o/p & filter capacitor operates (C)




- the pulsating o/p of the rectifier is applied across terminal 1&2 of a filter ckt
- the rectifier o/p contains AC & DC components
- the chock opposing passage of AC components & allow the DC components
- result is that most of the AC components appear across the chock while whole of the DC components passes through the chock the load resistor
- at terminal 3 rectifier o/p contains DC components
- in this way filter ckt has filtered out the AC components from the rectifier o/p & allow DC components to reach the load

## Capacitor I/P Filter (II Filter)-




- In this case an additional capacitor (C) is connected in begining across o/p terminal of rectifier
- It's shape like a greek letter π show it is named as π filter
- In this filter (L) is connected in series & $C_1C_2$ connected toparallel with the load

### Acion of $C_1$-

- It provide an easy path to AC components for bypass & block DC components which reached to the load

### Action Of L-

- It provide an easy path to DC components block the AC components

### Action Of $C_2$-

- Any AC components which inductor has to block is bypass by the $C_2$ capacitor & only pure DC appears across the load resistor $R_l$

## Adavantaegs-

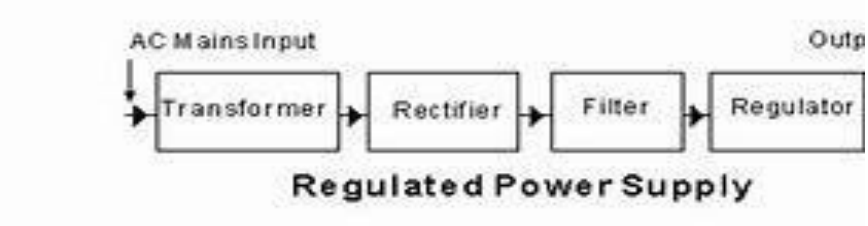
- It can be used with half wave as well as fullwave rectifier
- Ripples are almost zero
- O/p is almost pure DC

## Diadvantaeges-

- Cost ,size& weight effective

# 2.4 Dc Power Supply System With Help Of Block Diagram Only

### Block diagram




- When we design any electronics ckt , we need a DC voltage source- so we can easily design the constant DC source using the above ckt diagram.

### Transformer-

- The transformer i/p is 230 v AC voltage at primary winding & lower voltage in secondary winding because of step down transformer

### Rectifier-

- Rectifier converts AC voltage to pulsating DC voltage

### Filter-

- The function of filter ckt is to remove the AC components from the rectifier o/p & provide pure DC

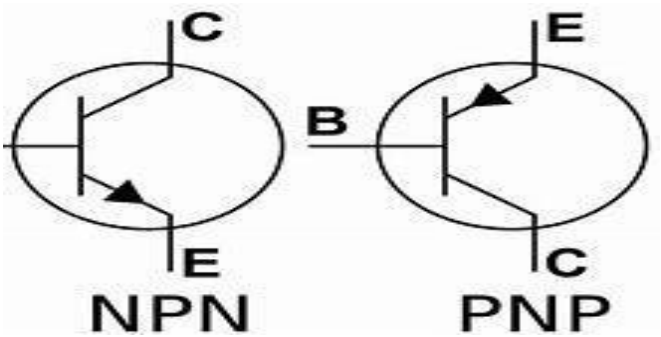
### Voltage Regulator-

- The voltage regulator receive the un regulated Dc voltage from the filter ckt& deliver constant regulated voltage

## 2.5 Different Types Transistor Configuration & State Output & Input Current Gain relationship in CE, CB & CC configuration (no mathematical derivation)

### Transistor-

- It is a semiconductor device which amplify the signal & control the current
- Transistor are two types
  - NPN transistor
  - PNP transistor

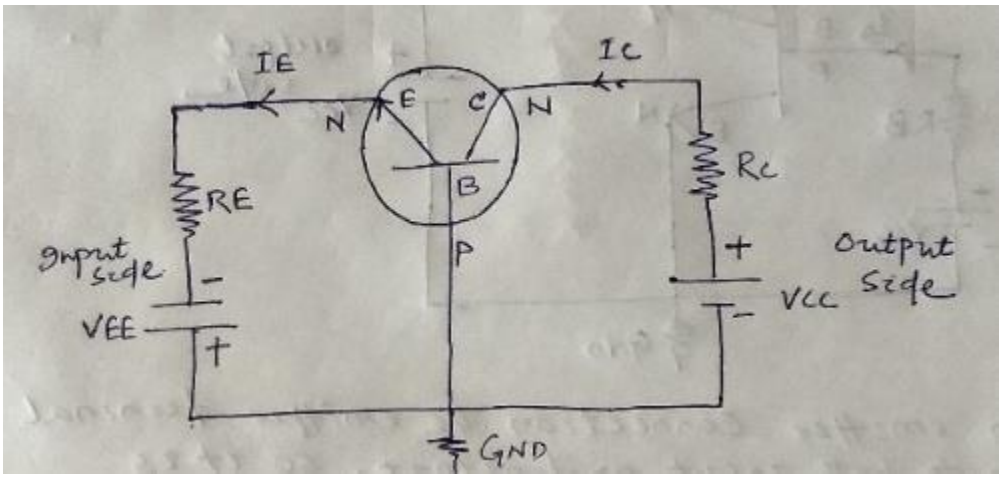



## Transistor Configurations-

There are three types of transistor configuration

(a) common base configuration
(b) common emitter configuration
(c) common collector configuration

## Common Base Configuration




- In this above ckt diagram the i/p is given between base & emitter ,and the o/p is taken between base & collector
- Since the base is common to both i/p & o/p so these connection is known as common base configuration
- Emitter current ($I_e$) is the i/p current & collector current ($I_c$) is o/p current

## Current Gain Amplification Factor(A)-

- As The o/p of transistor may be DC signal or AC signal . so current gain amplification factor can be devided into two types

(a) AC current gain($\alpha_0$)
(b) DC current gain ($\alpha$)

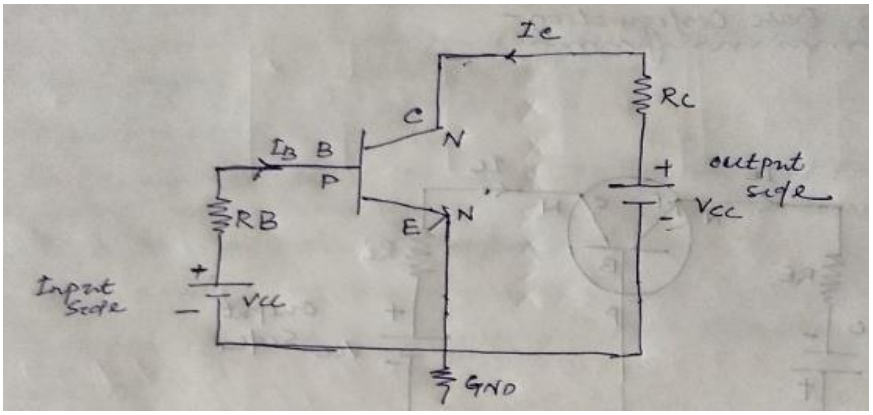
## AC current gain-

- It is ratio between the change in o/p current($\Delta I_c$) to the change in i/p current($\Delta I_e$)
  Mathematically $\alpha = \Delta I_c / \Delta I_e$

## DC current gain($\alpha$)-

- It is ratio between the change in o/p current($I_c$) to the change in i/p current($I_e$)
- $\alpha = I_c / I_e$

## Common emitter connection



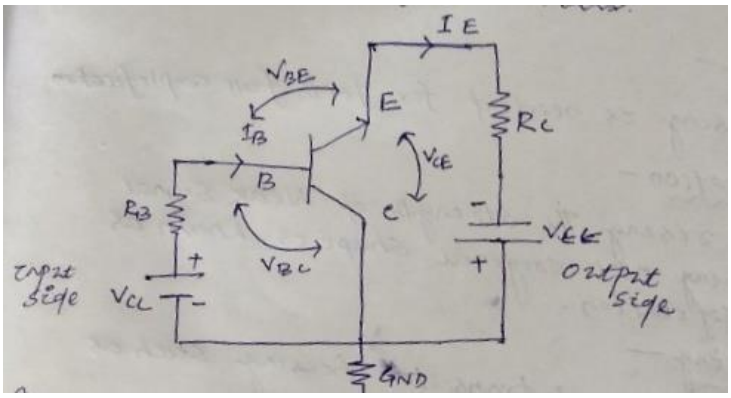

The Emitter is common to both i/p & o/p ,so it is called common emitter configuration

- above ckt diagram in this the i/p is given between base & emitter ,and the o/p is taken between emitter & collector
- base current ($I_b$) is the i/p current & collector current ($I_c$) is o/p current

## Current Gain Amplification Factor(B)-

- It is ratio between the change in o/p current($\Delta I_c$) to the change in i/p current($\Delta I_b$)
  Mathematically $\beta = \Delta I_c / \Delta I_b$

## Common Collector Configuration-




- The collector is common to both i/p & o/p ,so it is called common collector configuration
- Above ckt diagram in this the i/p is given between base &collector ,and the o/p is taken between emitter & collector
- Base current ($I_b$) is the i/p current & collector current ($I_e$) is o/p current

### Current Gain Amplification Factor(Λ)-

- It is ratio between the change in o/p current($\Delta I_c$) to the change in i/p current($\Delta I_b$)
  Mathematically $\lambda = \Delta I_e / \Delta I_b$

## 2.6-Need Of Baising & Different Types Of Baising With Circuit Diagram (CE -Configuration)

### Transistor Baising –

- The proper flow of zero signal collector current $I_c$& maintain proper collector ,emitter voltage $V_{ce}$ during the passage of signal is known as transistor baising
- Transistor baising make the base emitter junction is forward baised& emitter collector junction is reverse baised

### Need of baising-

- Transistor baising is needed for truthfull amplification

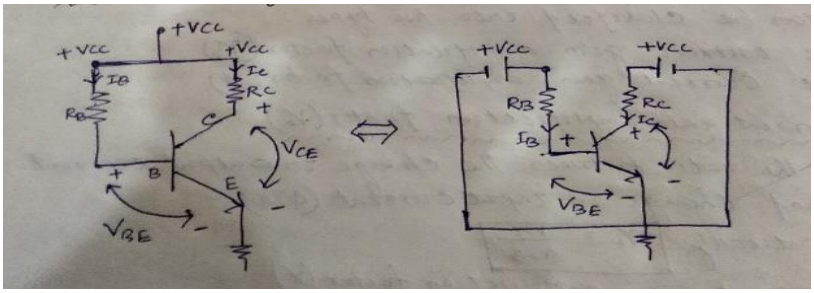
### Types of baising-

There are three types of transistor baising such as

(a) fixed baising

(b) Feedback resistor baising
(c) Voltage deviderbaising

## Fixed Baising-




Applying KVL at i/p side –

$+V_{cc}-I_B R_B - V_{BE} = 0$

$\Rightarrow I_B = (V_{cc} - V_{BE}) / R_B$

Out put current-

$I_c = \beta I_B = \beta [(V_{cc} - V_{BE}) / R_B]$ :.( $\beta = I_c / I_B$)

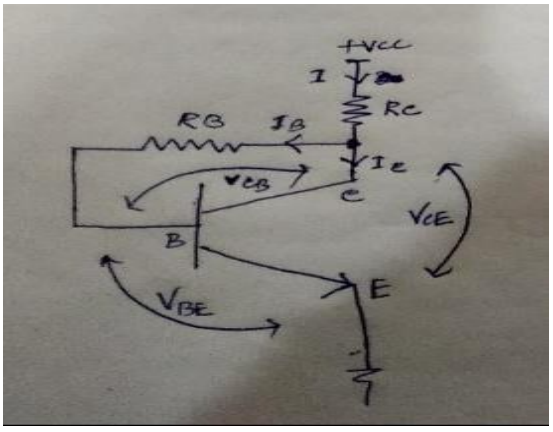
Applying KVL at o/p side

$+V_{cc}-I_c R_c - V_{cE} = 0$

$\Rightarrow V_{cE} = V_{cc} - I_c R_c$

- In this method the high resistance value is connected between the base & +ve end of the $V_{cc}$ supply for NPN transistor
- Here zero signal base current is provided by $V_{cc}$& it flows through $R_b$ because base emitter junction is forward baised
- The required value of zero signal base current $I_b$ can be made to flow by selecting proper value of base resistor $R_b$.

## Feedback resistor baising-




- In the baising one end of $R_B$ is connected to the base& the other end to the collector as shown if above fig.

Applying KCL

$I=I_c+I_B$

Applying KVL at input loop

$V_{cc}-I\,R_c - I_B\,R_B - V_{BE} = 0$

$\Rightarrow V_{cc}-(I_c+I_B)\,R_c - I_B\,R_B - V_{BE} = 0$

$\Rightarrow V_{cc}-(\beta\, I_B+I_B)\,R_c - I_B\,R_B - V_{BE} = 0 \qquad (\because \beta = I_c / I_B)$

$\Rightarrow V_{cc}-[(\beta+1)\,R_c + R_B]\,I_B - V_{BE} = 0$

$\Rightarrow I_B = (V_{cc} - V_{BE}) / [(\beta+1)\,R_c + R_B]$

$\Rightarrow I_c = \beta\, I_B = \beta\,((V_{cc} - V_{BE}) / [(\beta+1)\,R_c + R_B]$

Applying KVL at o/p loop

$V_{cc}-I\,R_c - V_{CE} = 0$

$\Rightarrow V_{cc}-(I_c+I_B)\,R_c - V_{CE} = 0$

$\Rightarrow V_{cc}-(I_c+I_B)\,R_c = V_{CE}$

## VoltgeDeviderBaising–

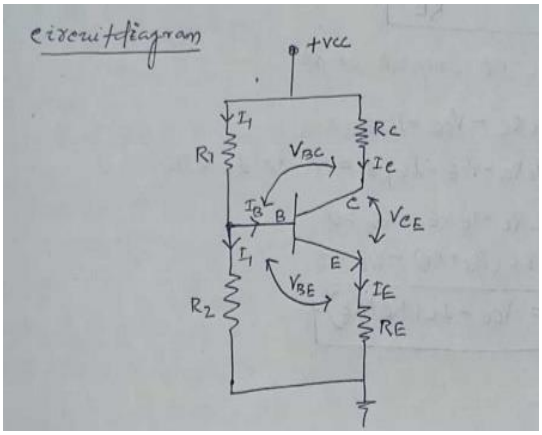
-This is the most widely used method of providing biasing & stabilization to a transistor .

-In this method two resistance $R_1$& $R_2$ are connected across the supply voltage $V_{cc}$& provide biasing .

-The emitter resistance $R_E$ provides stabilization .

- Here the voltage devided by $R_1$& $R_2$ resistor & the voltage drop across $R_2$ ,forward biases the base emitter junction .

## Circuit diagram



-Current flowing through the resistance $R_1$ is $I_1$ , as the base current $I_B$ is very small. There fore current flowing through $R_2$ is also $I_1$

$I_E=I_c+I_B$

$\Rightarrow I_E \equiv I_c$(:. $I_B$ is very small so it neglected)

Collector current ($I_C$)

-According to ohm's law (I=V/R)

$\Rightarrow I_1=V_{cc}/(R_1+R_2)$

Let voltage drop across $R_2$ is $V_2$

$\Rightarrow V_2=I_1*R_2$
$\Rightarrow V_2=V_{cc}/(R_1+R_2) * R_2$

Applying KVL at input side

$\Rightarrow V_2-I_E R_E - V_{BE}=0$
$\Rightarrow V_2-I_C R_E - V_{BE}=0$ $(I_E \equiv I_c)$
$\Rightarrow I_C = V_2 - V_{BE} / R_E$

Applying KVL at input side

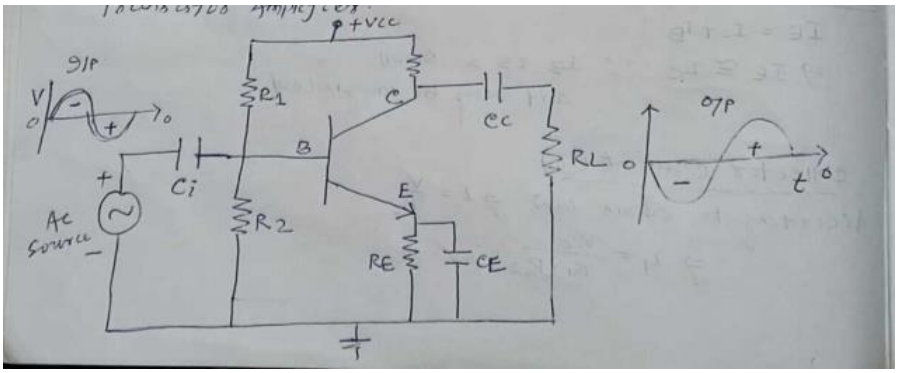
$V_{cc}-I_C R_c - I_E R_E - V_{CE}=0$

$\Rightarrow V_{cc}-I_C R_c - I_C R_E - V_{CE}=0$ $(I_E \equiv I_c)$
$\Rightarrow V_{cc}-I_C(R_c+R_E)-V_{CE}=0$
$\Rightarrow V_{CE}= V_{cc}-I_C(R_c+R_E)$

## 2.7 Amplifiers concept, Working principle of single Phase Rc Coupled Amlifier-

### Amlifier-

- Amplifier is the electronics ckt which raises the strength of weak signal is called amplifier




- When only one transistor is used for amplifying weak signal the ckt is known as single stage common emitter transistor amplifier
- Single stage common emitter $C_e$ transistor amplifier ckt diagram as shown above
- It consist of four resistor, three capacitor & one transistor

### Input capacitance ($C_{in}$)-

- An input capacitor ($C_{in}$) is connected in the ckt to couple with the base of the amplifier
- If $C_{in}$ is not present in the ckt then signal source will come across are to & change in baising voltage
- Capacitor $C_{in}$allow the AC signal to flow

### Coupling capacitor ($C_c$)-

- The Coupling capacitor ($C_c$) is connected couples one stage of amplification to the next stage

Due to($C_c$) only the AC signal will appear across the second amplifier stage

## 2.8 – Electronics Oscillator & It's Classification

### Oscillator-

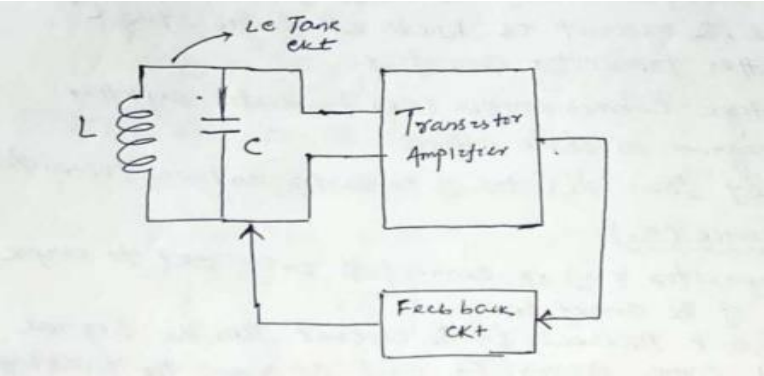
- An oscillator is a ckt which produces a continous repeated alternating wave form with out any i/p

-It is used for measurement of different types of wave signal

There various types of oscillator such as

(a) Heartly oscillator
(b) Colplict oscillator
(c) Wein bridge oscillator
(d) Phase shift oscillator
(e) Crystal oscillator

## 2.9-Working of basic oscillator with different element through simple block diagram




- The importance components of a transistor oscillator is

1- Tank ckt
2- Transistor amplifier
3- Feedback ckt

### Tank ckt-

- It is responsible for generation of desirable amount of frequency
- This ckt consist of inductor (L) & capacitor (C) connected in parallel
- The frequency of oscillator ckt depends upon the value of L &C .
- The frequency is required with L&C by the formula
- $f_0 = 1/ 2\pi LC$

### Transistor amplifier ckt-

- It is a ckt which amplified the weak signal
- The amplifier stage is generally used to provide the necessary strength as the signal is weak

### Feedback ckt-

- It is used for feedback the o/p of transistor amplifier to the tank ckt

## Possible Short Type Question With Answer-

### Q.1 - What Is Rectifier?

Rectifier is an electronics device which convert alternating current to direct current

### Q.2- What Are The Disadvantages Of Half Wave Rectifier

Ans- disadvantage of half wave rectifier-

- The pulsating current in the load contains AC components whose basic frequency is equal to the supply frequency
- It is low efficiency like 40.6%

### Q.3-What Are The Disadvantages Of Center Tape Full wave Rectifier ?

Ans- Disadvantage of center tape full wave rectifier

- It is expensive to manufacture center tape transformer ,in which produce equal voltage of each half of secondary winding

### Q.4- What Is The Function Of Filter Ckt ?

Ans- A filter is a device which removes the AC component of rectifier o/p & allow the pure DC to the load resistor

## Q.5- What Is Ripple Factor

Ans- It is the ratio of rms value of AC components present in rectifier o/p to the avg value of rectifier o/p

## Q.6- What Is Transistor?

Ans  It is a semiconductor device which amplify the signal & control the current

## Q.7- How many Transistors Biasing Are Present

Ans There are three types of transistor biasing such as

(a) fixed biasing
(b) Feedback resistor biasing
(c) Voltage deviderbaising

## Q-8- What Is Baising & Need Of Biasing?

Ans- The proper flow of zero signal collector current $I_c$& maintain proper collector, emitter voltage $V_{ce}$ during the passage of signal is known as transistor biasing

Need of biasing-

- Transistor Baising is needed for truthful amplification

## Q.9 –What Is Amplifier?

Ans- Amplifier is the electronics ckt which raises the strength of weak signal is called amplifier

## Q.10-What Is Oscillator?

Ans- An oscillator is a ckt which produces a continous repeated alternating wave form with out any i/p

## Possible Short Type Long Question

Q.1- Describe Rectifier & Explain Half Wave Rectifier

Q.2- Explain Bridge Type Fullwave Rectifier

Q.3- What Is Filtor& Explain Π Type Filter Details

Q.4- Explain Fixed Baising

Q.5-Explain Voltage Divider Baising

Q.6- Working Of Basic Oscillator With The Block Diagram-

Q.7- Working Principle Of Single Stage Common Emitter Transistor Amplifier

# CHAPTER-03
# COMMUNICATION SYSTEM

*Learning Objectives-*

*3.1 Basic communication system (concept & explanation with help of block diagram)*

*3.2-concept of modulation & demodulation, difference between them.*

*3.3- Different types of modulation (AM,FM & PM) based on signal, carrier wave & modulated wave (no mathematical derivation).*

## Communication:

Communication is the process of exchanging the information.

Communication is the process of connection or link between two point for information sharing.

The electronics components which are used for communication purpose is known as communication

## 3.1 Basic communication system (concept & explanation with diagram)


- The purpose of a communication system is to transmit intelligence signal from sourceto a destination at some point away from source. Figure is a block diagram of a communication system.
- This system consists of 3 basic components i.e. transmitter, channel and receiver.
- The transmitters function is to process the message signal into a form suitable for transmission over the communication channel. This is called modulation. As for the communication channel, its function is to provide a pathway between the transmitters output and the receiver input.
- The job of the receiver is to process the received signal to recover the appropriate message signal

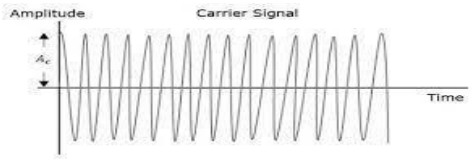
## 3.2 Concept of Modulation & Demodulation, Difference between them-

- The process of changing some characteristic like amplitude, frequency and phase of carrier wave in accordance with the intensity of the signal is called modulation.

Carrier signal:

It is a high frequency signal.

As the name indicates,the function is to carry the information or modulating signal from the transmitter to receiver.




## Need for modulation-

Modulation is extremely necessary in communication system due to the following reason

1. Practical antenna length
2. Operating range
3. Wireless communication

**Demodulation-** The process of recovering audio signal from the modulated wave is called demodulation.

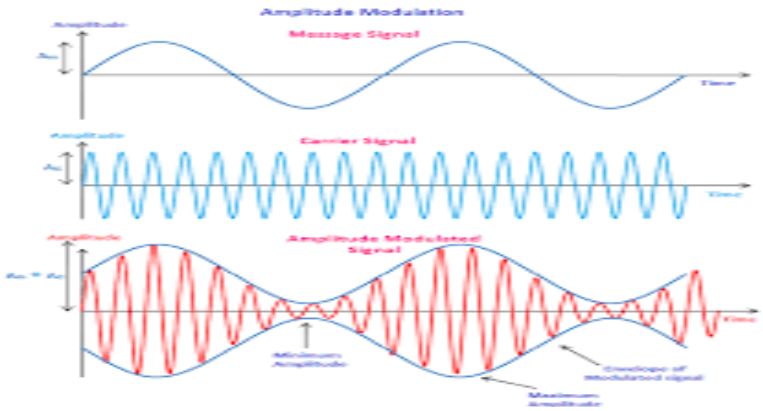
## Difference between modulation and demodulation-

| Parameter | Modulation | Demodulation |
|---|---|---|
| Definition | Modulation is the process of varying the parameter of the carrier signal according to message bearing signal. | Demodulation is the processby which message signal is extracted from the modulated wave. |
| Operating End | Transmitting end | Receiving end |
| Operation | Simple | Complex |
| Frequency | Low to high | High to low |

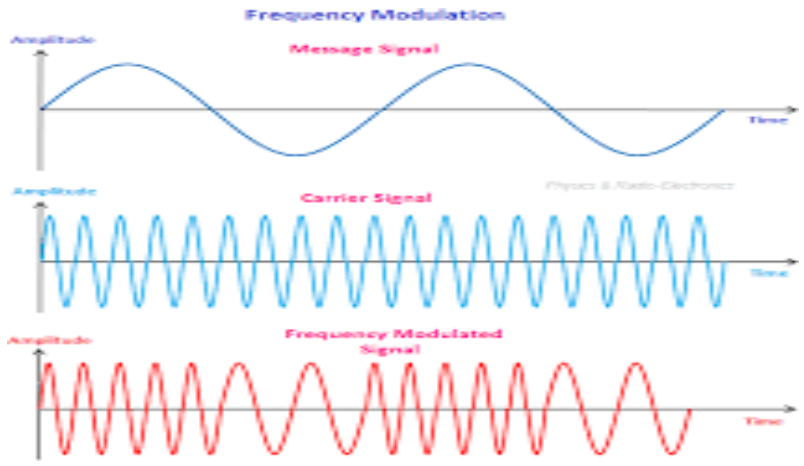
## 3.3 Different Types of modulation(AM,FM & PM) based on signal,carrier wave & modulated wave (no mathematical derivation)-

i. Amplitude modulation
ii. Frequency modulation
iii. Phase modulation

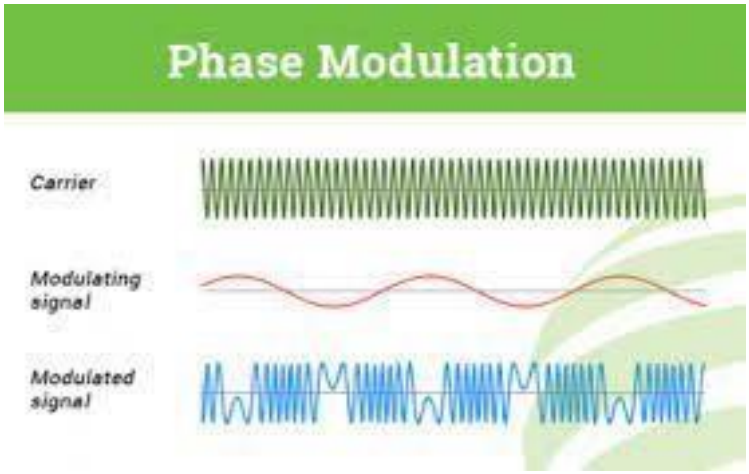
I. Amplitude modulation- When the amplitude of high frequency carrier wave is changed in accordance with the intensity of the signal is called amplitude modulation




II. Frequency modulation- When the frequency of a carrier wave is changed in accordance with the intensity of the signal is called frequency modulation




Phase modulation- It is a modulation pattern for conditioning communication signal for transmission. It encodes a message signal as variation in the instantaneousphase of a carrier wave.



## Short question with answer

### Q1-What is carrier wave and modulated wave?

Ans. Carrier is a wave form usually sinusoidal that is modulated with input signal for the purpose of conveying information. This carrier wave is usually a much higher frequency than the input signal.

Modulation is the process of varying one or more properties of a periodic wave form called the carrier signal with a modulating signal that typically contains information to be transmitted.

### Q2. **Define amplitude modulation?**

Ans. When the amplitude of high frequency carrier wave is changed in accordance with the intensity of signal is called amplitude modulation

### Q3. **Define frequency modulation?[s-18]**

Ans. When the frequency of a carrier wave is changed in accordance with the intensity of the signal is called frequency modulation.

## LONG QUESTION

**Q1.** Write difference between AM & FM.

**Q2.** Explain the communication system with help of block diagram.[W-20,S-19]

# CHAPTER-04

# TRANSDUCER AND MEASURING INSTRUMENT

*Learning Objectives-*

*4.1- Concept of Transducer & sensor with their difference*

*4.2-Different types of transducer & concepts of active & passive transducer*

*4.3Working principle of Photo emissive, photoconductive, photovoltaic transducer & it's application.*

*4.4 Multimeter &it's application*

*4.5 Analog and digital multimeter and their difference-:*

*4.6 Working principle of multimeter with basic block diagram-*

*4.7 CRO, Working principle of Cathode ray oscilloscope with simple block diagram.*

## 4.1-Concept of Transducer & sensor with their difference-

A transducer is a device which converts the energy from one form to another form that is mechanical force to electrical energy

**Primary sensor**-

- A primary element is a sensor or detector that responds quantitatively to the measured variable and performs the initial measurement operation. A primary element performs the initial conversion of measurement energy.
- A sensor is a device that detects and responds to some type of input from the physical environment

**Difference between primary sensor and transducer-**

- As the term suggests, sensor is a body which reacts to a physical, chemical or biological condition. It senses .It can be considered as a detector.
- The conversion of energy from one form to another is known is known as transduction. A transducer serves for this purpose.
- A sensor can sense in any form i.e. due to some mechanical change. It can react in electrical form. Thus there is a conversion similar to that of transducer.

- A transducer is more than a sensor. It consists of a sensor/ actuator along with signal conditioning circuits.
- The main difference between sensor and transducer is that a transducer is a device thatcan convert energy from one form to another where as sensor is a device that can detect a physical quantity and converts the data into electrical signal. Sensors are also atype of transducers.

## 4.2-Different types of transducer & concept of active & passive transducer-

The transducer can be classified as

i. Resistive transducer
ii. Inductive transducer
iii. Capacitive transducer
iv. Primary& secondary transducer
v. Passive and active transducer

### Active and Passive transducer-

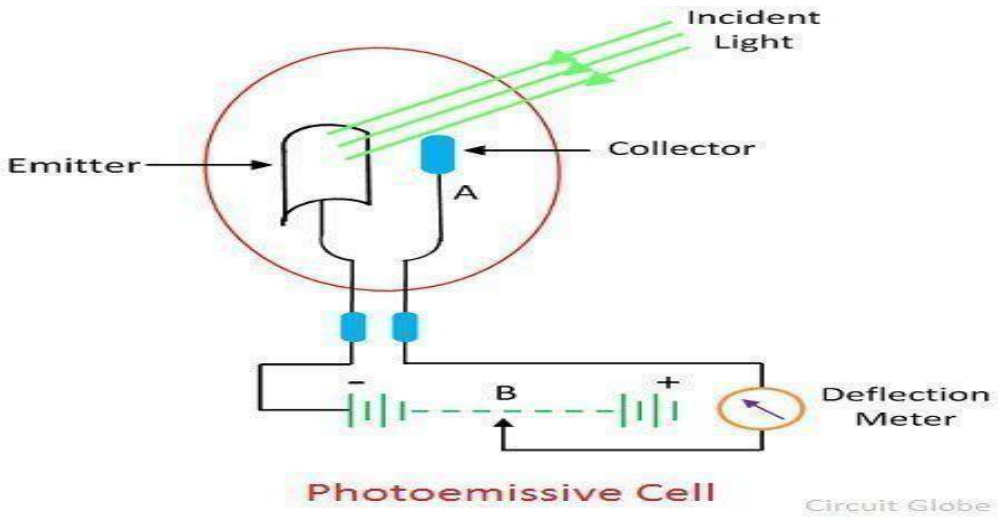
- Active transducer are also known as self generating transducer. They develop their own voltage or current

Ex-: Thermocouple & photovoltaic cell.

- Passive transducers are also known as externally powered transducer. In this transducer, the power required for the energy conversation takes from an external source.
- Ex- Hall effect generator

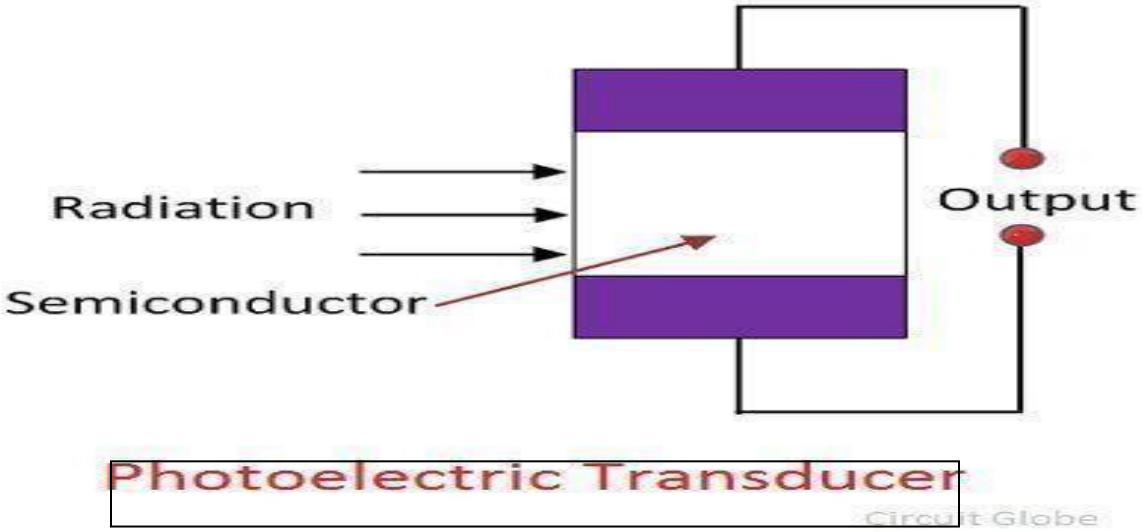
## 4.3-Working principle of Photo emissive,photoconductive,photovolatic transducer & it's application.

It consists of a cathode and an anode mounted in a vacuum tube made of glass. This cathode consists of a curved metal plate made of photosensitive material such as cesium or oxidized silver. The anode is made of nickel or platinum. When radiation of frequency above the threshold frequency falls on the cathode, electrons are emitted and flow to the anode constituting an electric current.




**Application-:** It is used in biomedical applications.

## Photoconductive transducer-

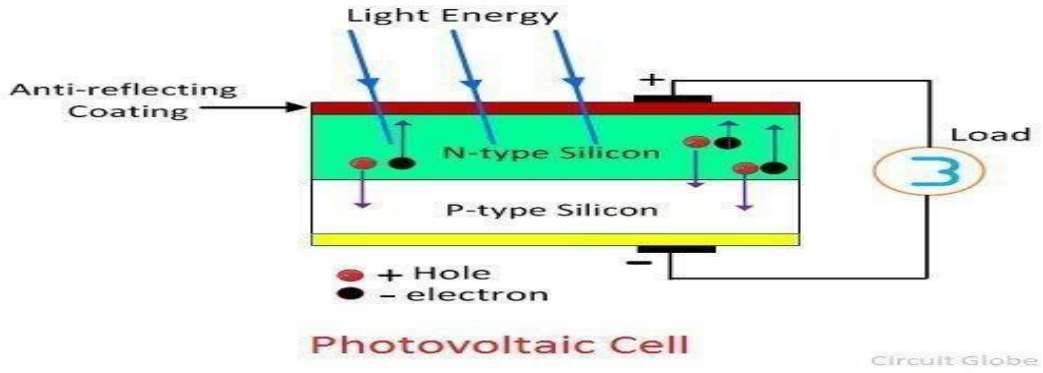



- **T**he photoelectric transducer can be defined as a transducer which changes the energy from light to electrical. It can be designed with the semiconductor material. This transducer utilizes an element like photosensitive which can be used for ejecting the electrons as the light beam soaks ups through it.

Application-

1) It records body movement.

**Photovoltaic transducer-**




- It converts electromagnetic radiation into an electrical signal. The semiconductor materials that can be used in cell are silicon, germanium, selenium, antimonite. When the cell is exposed to light, a voltage is generated across the junction.
- Application- They can be used as energy converter used in space craft, data processing industries

## 4.4-Multimeter &it's application

- This is a multipurpose instrument as its name indicates and is used for measurementof current(DC & AC),Voltage(DC& AC) and resistance. It is a simple, compact and portable instrument. It may be analog or digital type.
- Application-: It is used in laboratory. It is also used in industry.

## 4.5-Analog and digital multimeter and their difference-:

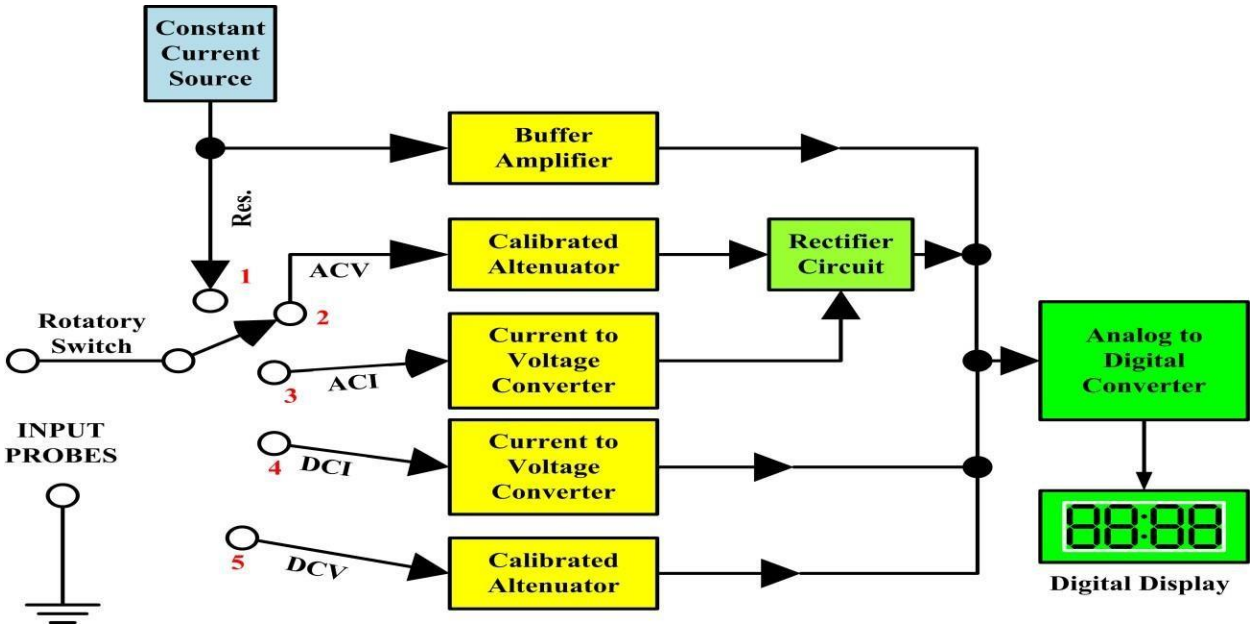
I. Digital multimeter has greater speed, better resolution and reduction in operator error.

ii. Digital multimeter use logic circuit.

iii. Digital multimeter has better readability of the measurement result because of the digital readout.

iv. Digital multimeter are more accurate than analog one.

## 4.6-Working principle of multimeter with basic block diagram-

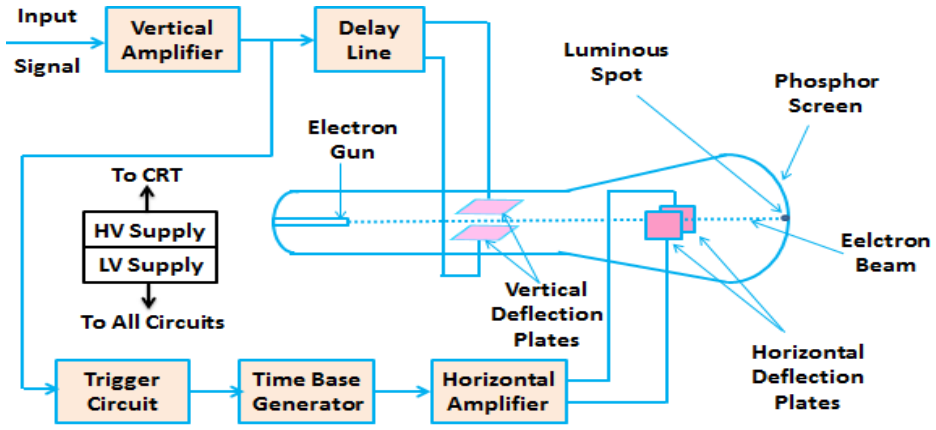



- A digital multimeter (DMM) is a multifunctional meter that displays its electrical quantitative values on an LCD screen. A digital multimeter much like an analog meter, it is able to read voltage, current, and resistance. What makes a digitalmultimeter differ from the analog meter is its ability to display measured electrical values quickly without any computations.
- Because of its design, a processor can be built into the meter which allows the user to take measurements of frequency, the inductance of a coil, capacitance of a capacitor, and a host of other high functional electrical measurements.
- There two types of digital multimeters (DMM): **scalable digital multimeter** and **auto-ranging digital multimeter** as shown in figure When working with the scalable digital multimeter you need to have an idea of the value of voltage,current, or resistance that you are attempting to measure.
- Failure to observe these values will result in inaccurate readings and possible damage to the meter. The auto-ranging digital multimeter is more widely used due to its ease, high functionality, and quick display readings achieved without the user completing the calculations.

## 4.7-CRO,Working principle of Cathode ray oscilloscope with simple block diagram-

CRO is an extremely useful and most versatile laboratory instrument. It is used for studying the shape of AC & DC voltage & current. As well as it can measure AC & DC current, frequency & voltage.

## Block diagram of CRO-




Block Diagram of Cathode Ray Oscilloscope (CRO)

**1.** CRO tube-: Electron beam is generated due to heat. It accelerates the beam to a high velocity.

**2.** Vertical amplifier-: It is required because signals are not strong enough to produce a deflection on CRT screen.

**3.** Horizontal amplifier-: It amplifies sweep generator output.

**4.** Vertical deflection system-: Vertical deflection is produced due to the voltage applied to the' y" plate

**5.** Horizontal deflection system-: The horizontal amplifier increases the amplitude of the input signal.

**6.** Sweep generator-: It produces saw tooth voltage wave form.

## Measurement of frequency-

The signal whose frequency is to be measured is applied to the' y" plate standard variable frequency source. It is used to supply voltage to "X" plate with the internal sweep generator off. The standard frequency is adjusted until the pattern appears as a circle or as an ellipse indicating that both signals are of same frequency.

## Probable Short question with answer

**Q1. What is transducer ? give it's application.[W-16,19,20, S-17]**

Ans. A transducer can be defined as a device which converts a non electrical quantity intoan electrical quantity.

Application- Piezoelectric transducer ,LVDT

**Q2. Classify different types of transducer.[W-18,19,S-19]**

Ans. A thermocouple is the most simplest control used in measuring temperature.

**Q3. What is CRO?**

Ans.CRO is an extremely useful and most valuable laboratory instrument used for studyingthe shape of AC & DC voltage.

## Long question

**Q1. What is multimeter and write the difference between analog & digitalmultimeter? [W-17]**

**Q.2- Describe Working principle of multimeter with basic block diagram . [W-17,18]**

## REFERENCE BOOK


| SI NO | TITLE OF BOOK | AUTHOR |
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| 2 | ELECTRONICS CIRCUITS | DR.R.SEDHA |

vi.