Important Instruction to examiners:

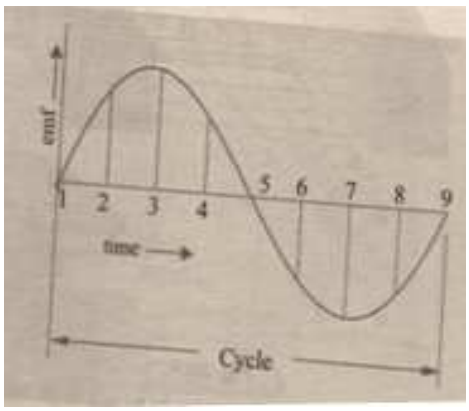
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance.(Not applicable for subject English and Communication Skills)
4) While assessing figures, examiner may give credit for principle components indicated in a figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case some questions credit may be given by judgment on part of examiner of relevant answer based on candidate understands.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

SECTION -I

Q.1 Attempt any Nine of the following **18 Marks**

a) Draw A.C waveform and defined frequency of signal. State its unit (Figure-1 Marks, Defination-1/2, Unit-1/2 Mark)

A.C waveform:-



Frequency:

The number of cycles completed by an alternating quantity in one second is called as frequency.

Unit: Hertz (Hz)

b) Define power factor .

Power factor: **(Marks Allotted -2)**

i) It is ratio of true power (active power) 'P' to the apparent power 'S'

$$P.F = \frac{Active\ \ Power(P)}{Apparant\ Power(s)}$$ **OR**

ii) It is defined as cosine angle between voltage and current. **OR**

iii) It is the ratio of resistance 'R' to the impedance 'Z.

$$Cos\phi = \frac{\text{Re}\, sis\tan ce\,(R)}{\text{Im}\, pedance\,(Z)}$$ **OR**

i) Power factor is defined as how much current is utilized out of total current

c) State Faraday's law of electromagnetic induction. **(Marks Allotted - 02)**

Second Law of electromagnetic Induction:-

The Magnitude of induced emf is directly proportional to (equal to) the rate of change of flux linkages.

$$e = \frac{-Ndt}{dt} d\phi$$

Where, N= Number of turn

$\frac{d\phi}{dt}$ = Rate of Change of flux

d) State different types of DC Motor. …….(Marks Allotted - 02)

Types of Dc Motor

i) DC Shunt Motor ii) DC Series Motor

iii) DC Compound Motor: a)Short Shunt Compound Motor

b) Long short compound Motor

e) What is back EMF? State its significance. (Definition 1mark & significance Mark - 1)

Back EMF :-

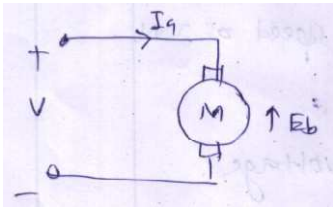
$$E_b = \frac{\phi Z N P}{60A}$$

Where, E_b = Back EMF ϕ = Flux

Z = Total number of conductor N = Speed of DC Motor

P = Number of Pole A = Armature parallel path

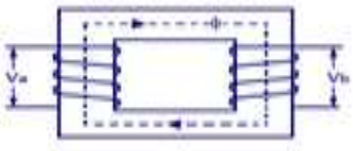
Whenever DC voltage is provided to the armature winding of DC motor then E.M.F is induced in reverse direction in armature that induced is called as Back emf. Due to back emf armature current reduces.



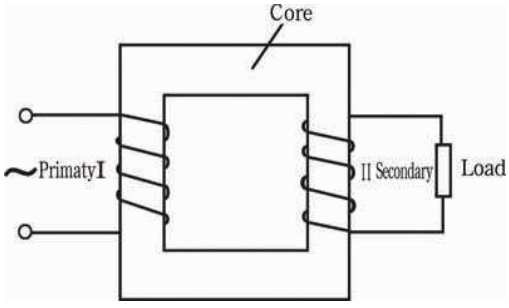
$E_b = V - I_a R_a \quad \therefore I_a R_a = Armature\ resis\tan ce\ voltage\ drop,\ V = input\ DC\ voltage$

f) Draw neat diagram of core type transformer ……..(Marks Allotted - 02)

Core type transformer:



OR



g) State two advantages of induction motor. ……..(Marks Allotted - 02)

Advantages of Induction Motor:

1. Simple and rugged in construction.
2. High overload capacity.
3. It can operate over a constant speed.

4. Less maintaince is required.
5. High starting torque with low starting current.
6. Smooth acceleration under heavy load
7. No abnormal heating during staring.
8. Speed can be easily adjusted.

h) Give classification of drive…….. (Marks Allotted - 02)

Classification of drive:

i) Individual Drive ii) Group drive iii) Multimotor Drive

i) State principle of electrical Heating: …… **(Marks Allotted - 02)**

Principle of Electric Heating :-

When current flows through the resistance heating element, Heat is produced due to I^2R Losses taking place in heating Element. This heat is transferred towards charge either by radiation or conduction.

j) Give applications dielectric heating (any two) …… (Marks Allotted - 02)

Applications of Dielectric Heating :-

1) In food processing industry, dielectric heating is used for Baking of cakes & biscuits in bakeries. Cooking of food without removing outer shell (eg-boiled egg)and platerizing of milk.
2) For Rubber vulcanizing.
3) In Tobacco manufacturing industry for dehydration of tobacco.
4) In wood industry for manufacturing of ply wood.
5) In plastic Industry for making different containers.
6) In cotton industry for drying & heating cotton cloths for different processes.
7) In tailoring industry for producing threads.
8) For manufacturing process of raincoats & umbrellas.
9) In medical lines for sterilization of instruments & bandages.

10) For heating of bones & tisors of body required for certain treatment to reduces paints & diseases.
11) For removal of moisture from oil.
12) For quick drying gum used for book binding purpose.
13) In foundry for heating of sand, core, which are used in molding processes.

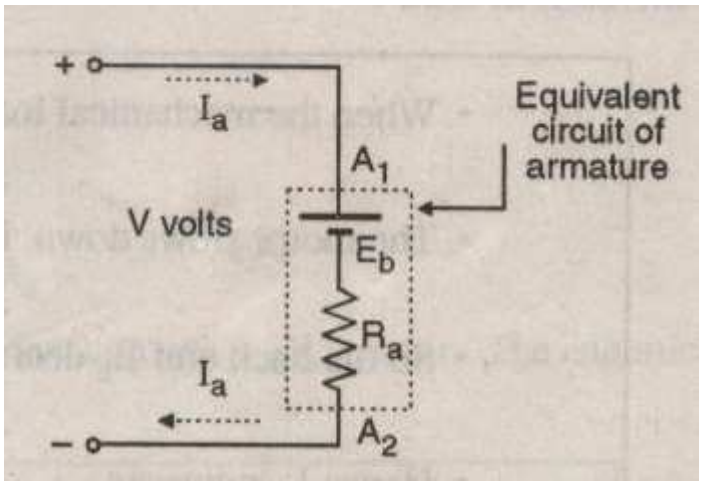
k) What is Electrolysis? **(Marks Allotted - 02)**

Principle of Electrolysis :-

In Nature electrolyte is combination of Ions which are closely bound together but bond becomes weaker, when dissolved & the molecules of the electrolyte split upto two types of ions carrying electric charges called cations & anions, and moving freely in the solution. Now if two electrodes are dipped into the electrolyte & connected to the D.C Supply, ions associated with positive charge & moving freely in the solution are attracted by the cathode & the ions associated with negative charge & moving freely in the solution are attracted by the anode.

Q.2 Attempt any Four of the following:

a) Give expression for voltage equation of DC motor and describe it. (Equation- 02 marks & description 2 marks.)



Expression for voltage equation of DC motor:

$$V = E_b + I_a R_a + \text{V}$$

But the voltage drop across the brushes in negligible

$$V = E_b + I_a R_a$$

The expression for Ia is given by $Ia = \frac{V - E_b}{R_a}$

Where,

V= terminal voltage E_b= Back emf

I_a = Armature current R_a = Armature resistance

b) Given data:

$V_I = 2200V$ $V_2 = 200V$ $N_I = ?$ $N_2 = 66$ $I_1 = ?$ $I_2 = ?$

Step-I: To Find N_1:

$\frac{V_1}{V_2} = \frac{N_1}{N_2}$, $N_1 = \frac{V_1}{V_2} \times N_2$ …… (½ marks)

$N_1 = \frac{2200}{220} \times 66$

$N_1 = 660$ *turns* …….. (1 mark)

Step-II: To Find I_1:-

$I_1 = \frac{KVA}{V_1}$ …….. (1/2 marks)

$I_1 = \frac{20 \times 10^3}{2200}$

$I_1 = 9.09$ *Amp* ……..(1mark)

Step-III: To Find I_2:

$I_2 = \frac{KVA}{V_2}$

$$I_1 = \frac{20\times10^3}{220}$$

$I_1 = 90.9 \ Amp$ ..... (1mark)

c) Define voltage transformation ratio of the transformer. State condition for step up and step down transformer

Transformation Ratio (k):- ---------- **(2 Marks)**

It is the ratio of secondary number of turns to primary number of turns. OR It is the ratio of secondary voltage to primary voltage. OR It is the ratio of primary current to secondary current.

$$Transformation \ \ ratio\ (k) = \frac{N_2}{N_1} \ or = \frac{E_2}{E_1} \ or = \frac{V_2}{V_1} \ or = \frac{I_1}{I_2}$$

Condition for step up and step down transformer: ..... (2 Marks)

- **Step up**- when $N_2 > N_1$ or when $V_2 > V_1$ or when $K > 1$, then it is called as step up transformer.
- **Step down**- when $N_1 > N_2$ or when $V_1 > V2$ or when $K < 1$, then it is called as step down transformer.

d) State the different types of enclosures used in electrical drives. State its method mounting.

Enclosures **(2 Marks)**

1. Open type enclosure
2. Screen protected enclosure
3. Drip (moisture) proof enclosure
4. Flame (fire) proof enclosure
5. Totally enclosed type enclosure
6. Pipe ventilation totally enclosed type enclosure :

Method of mounting **(2 Marks)**

1. Open type enclosure: where motor is installed
2. Screen protected enclosure: Provided for rotating parts for better protection & where motor is installed
3. Drip (moisture) proof enclosure: Water pumping station, Motor on ship, sub-miscible motor etc
4. Flame (fire) proof enclosure: Chemical plants, Mines etc
5. Totally enclosed type enclosure: Saw mill, stone crushing plant, coal handling plant, cement manufacturing plant and cotton industry etc.
6. Pipe ventilation totally enclosed type enclosure : Stone crushing, coal handling plant, cement industry, cotton industry, saw mill etc

e) State principle of resistance heating. Give its applications.

Principal of Resistance Heating:- …… (2 Marks)

- When the current is passed through heating element heat is produced due to I^2R loss.
- To produce more amount of heat in less time in case of industrial resistance furnace large amount of current is passed through heating element.
- This heat is utilized to heat the charge directly (conduction) or indirectly (radiation)
- Heating element is made of high resistivity material such as nichrome.
- Heating element may be in the form of wire or strip.

Application of resistance heating: …….. **(any two application 2 Marks)**

i) Geyser ii) Salt bath, iii) Electrical iron iv) Toaster v) Resistance oven vi) All types of water heater

f) Describe active and reactive power.

Active power (P):- …… (2 Marks)

The true power or active power is defined as the actual power consumed by the given circuit. **OR**

It is given by

$P = V.I.Cos\phi \ watt$ **Unit: -** Watt **OR** Kwatt

Where, ϕ = Phase angle between V and I

Reactive Power (Q):- ……(2 Marks)

The reactive power is defined as the product of V, I and sine of angle between V and I i.e. ϕ **OR**

It is the power taken from the source by inductive or capacitive element which is not actually consumed.

The reactive power is also called as imaginary power.

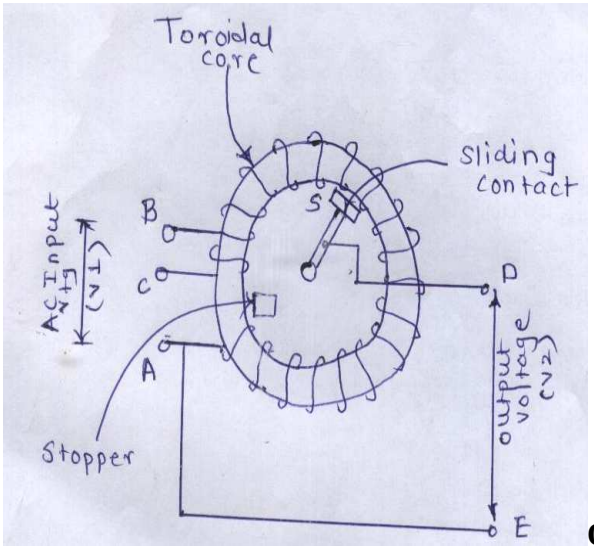
It is given by **OR**

Q= V.I. sin ϕ

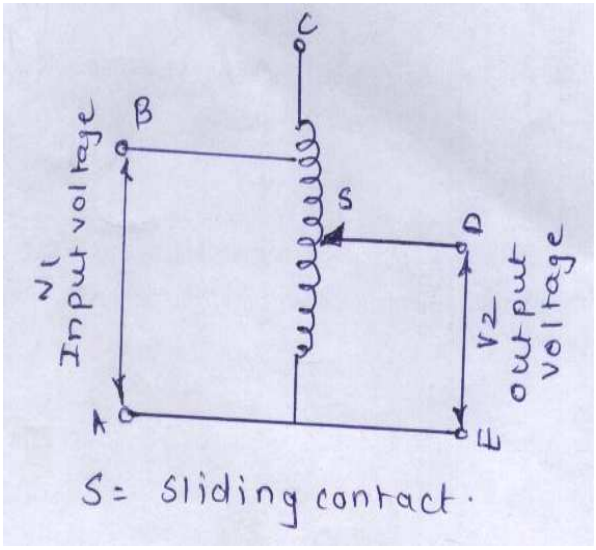
Units: - VAR **OR** KVAR

Q.3 Attempt any four of the following:…….. (16 Marks)

a) Draw neat constructional sketch of autotransformer and state its advantages



OR



or Equivalent fig

Diagram…… **(2 Marks)**

Advantages of autotransformer… **(2 Marks)**

1) Weight of copper required it is less
2) It is cheaper
3) The resistance and leakage reactance of an auto transformer is less than two winding transformer.
4) Core losses are less

5) Efficiency is higher

OR

Advantages of autotransformer-

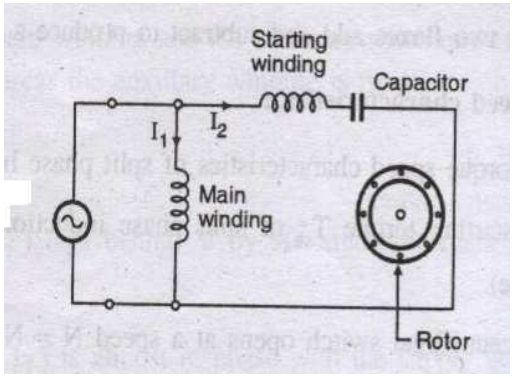
1. Saving of copper takes place.
2. Voltage regulation of autotransformer is better.
3. Autotransformer is smaller in size.
4. Cost is reduced in autotransformer as compared to conventional two winding transformer.
5. Losses are less in autotransformer.

b) With neat diagram describe operation of single phase induction motor.

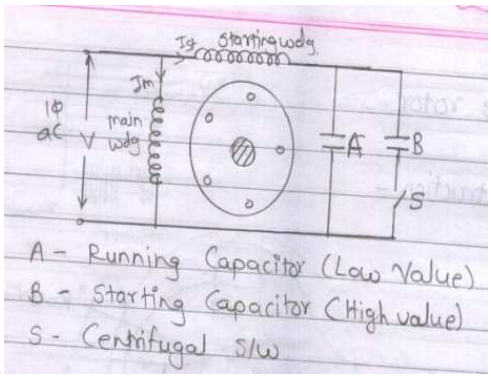
Single phase induction motor is not self starting to make self start their various method from which the names are given to 1-ph induction motor for example

Note: For model answer following type of single phase induction motor is explain accept any one type of 1-phase induction motor

Capacitor-start capacitor run 1-Ph Induction Motor:-



OR



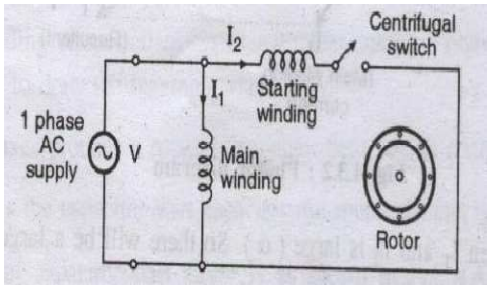
or Equivalent fig……(2 Marks)

Working Principle: …… (2 Marks)

In these motors one capacitor is connected in series with the auxiliary winding. There is no centrifugal switch. Thus this winding along with the capacitor remains energized for both

starting and running conditions. Capacitor used serves the purpose of obtaining necessary phase displacement at the time of starting and also improves the power factor of the motor.

Working of Resistance start induction motor :-



or Equivalent fig.

In these motors the stator winding is spilleted in to two different windings .Main winding and auxiliary winding . A high resistance is added in series with the auxiliary winding along with centrifugal switch. When single phase supply is applied across the motor, stator will draw two different currents which are displaced by some angle from each other and motor starts as a two phase motor. Once the motor picks up the speed and reaches to 70 percent of the rated speed due to centrifugal action auxiliary winding is detached from the system and motor continues to run with only main winding.

c) Define Slip. Give expression for synchronous speed and slip speed

Slip:- …… **(2 Marks)**

It is the ratio the difference between the synchronous speed and actual speed of the rotor to synchronous speed.

It is expression in percentage =

$$\% \text{ Slip} = \frac{N_S - N}{N_S}$$

Slip speed = $N_S - N$ …… **(1 Marks)**

Where, N= Rotor speed

Expression for synchronous speed:- …… (1 Marks)

$$N_S = \frac{120\ f}{p}$$

Where, N_S = Synchronous speed, f= frequency P= Number of pole

d) State criteria for selection of the drive. …… (any four point each having 1 mark)

Factors to be considered for selection of Electrical Drives:

1) Nature of Supply:- Whether supply available is AC, pure DC or rectified DC

2) Nature of Drive :-Whether motor is used to drive individual machines or group of M/c

3) Nature of Load :- Whether load required light or heavy starting torque or load having high inertia require high starting torque for long duration.

4) Electric Characteristics of drive: - Starting, Running, Speed control and braking characteristics of electric drive should be studied and it should be match with load.

5) Size and rating of motor: - Whether motor is continuously running, intermittently running or used for variable load cycle.

6) Mechanical Consideration: - Types of enclosure, Types of bearings, Transmission of power, Noise level, load equalization

7) Cost: - Capital, Running and maintenance cost should be less

e) Differentiate between resistance heating and induction heating.

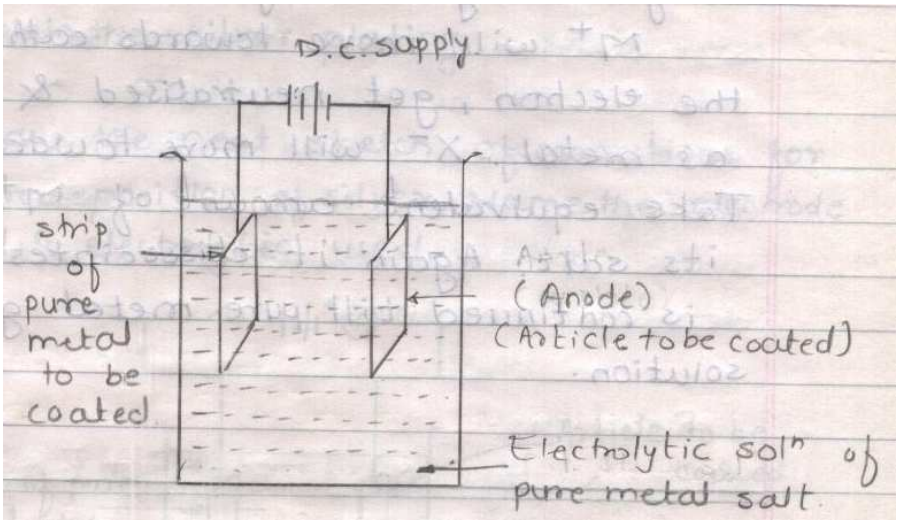
…… (any four point each having 1 mark)

S.No	Points	Resistance heating	Induction Hating
1	Principle	Based on principle of losses takes place in heating element (I^2R loss)	Based on faradays law of electromagnetic induction
2	Application	Heat is produced in heating element	Heat is produced directly in the charge to be changed
3	Heating element	Heating element is used	No Heating element required

4	Types	1. Direct resistance heating 2. Induction resistance heating	1. Direct core type 2. Indirect core type 3. Core less
5	Cost	Less	High
6	Life	Less	More
7	Capacity	Built for small capacity	Built for long capacity

f) Describe process of electroplating. State its application

Process of Electroplating:- …… (2 Marks)



or equivalent fig

A DC current passed through a solution of chemical compound then the solution can be dissociated into its constituent's parts & deposition of metal takes place on the cathode. Metal is the constituent part of the solution.

The solution used for electrolysis due to which electroplating is to be carried out is known as electrolyte or salt solution. In such a solution each molecule of the substance dissolved is negatively charged.

Electroplating is carried out with a desire to coat particular metal on the surface of other metal. At first, the orticle be coated is properly cleaned. Then it is made cathode. The metal of

which coating is desired is taken in pure form as a strip & it is connected to anode. In an electrolytic bath, Solution of the salt of the pure metal to be coated is taken By closing the key.

M^+ will move towards cathode, accept the electron, get neutralized & depositioned as metal .X^- will move towards anode. Take equipment amount of M^+ & from its salt. Again it dissociates & process is continued till pure metal goes into solution.

Application of Electroplating: …… (2 Marks)

1. Protection of metal against corrosion.
2. Repairing worn out parts of machinery.
3. Giving shining experience to metal parts for decoration purpose.

----------**SECTION-I END**----------

SECTION-II FORM PAGE NO.15

SECTION -II

Q-4 Attempt any Nine of the following

a) Define intrinsic and extrinsic semi conductor. **(Marks Allotted – 2)**

Intrinsic semiconductor- (1 Mark each)

The semiconductor which is in purest form like Si, Ge (without trivalent or pentavalent impurities/ doping) is called "Intrinsic semiconductor."

Extrinsic semiconductor-

The semiconductor which is having doping of trivalent materials (Boron , Aluminium) or pentavalent materials (Phosphorus , Arsenic) is called "Extrinsic semiconductor."

b) Give two examples of passive component and active component. **(Marks Allotted – 2)**

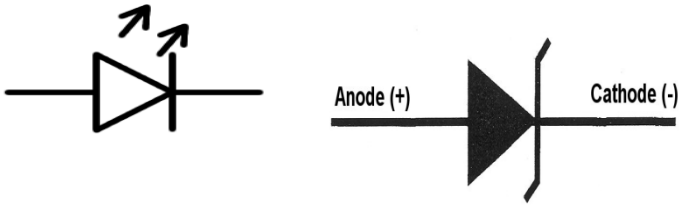
Passive components - Resistors, Capacitors, Inductor. (1 Mark)

Active components - Diode , BJT , FET (1 Mark)

c) Draw neat symbol of light emitting diode and zener diode. **(Marks Allotted – 2)**

Symbol of LED & ZENER (1 Mark each)

LED- **Zener Diode**



d) Give two uses of indicator and capacitor. **(Marks Allotted – 2)**

Use of Inductor & Capacitor-

As an energy storing component in filters , oscillators , multivibrators and lead-lag networks.

e) Draw neat circuit diagram of half wave rectifier along with input and output waveform.

(Marks Allotted – 1 Mark for diagram and 1 Mark for waveforms)

Half wave rectifier-

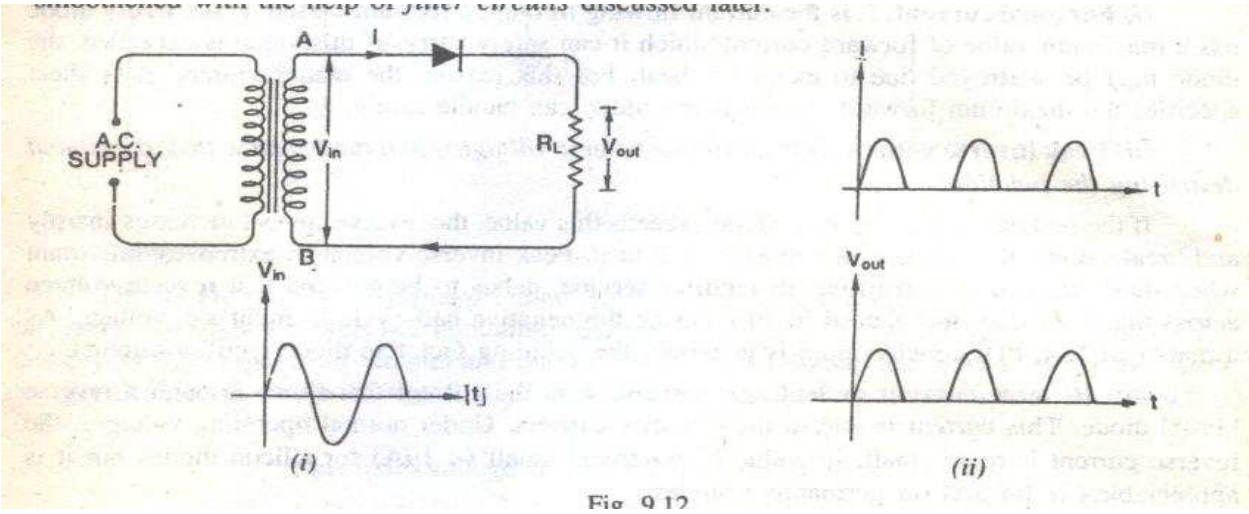
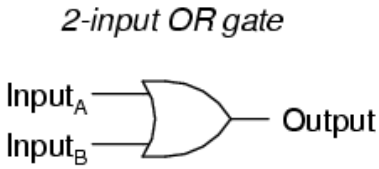


Fig. 9.12

f) Draw symbol and truth table of i) OR gate ii) Not gate **(Marks Allotted – 2)**

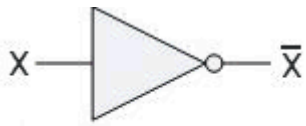
Symbol & truth table for OR & NOT **(1- Mark Each gate)**

OR Gate:



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

NOT Gate:



NOT GATE

Input	Output
1	0
0	1

g) Define filter. State its function. **(1 Mark definition and 1 Mark for function)**

Filter-

Electronic filters are electronic circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal.

Functions – 1) To remove AC components & give pure DC output in rectifiers

2) To remove high or low frequencies from input in low pass filter or high pass filter.

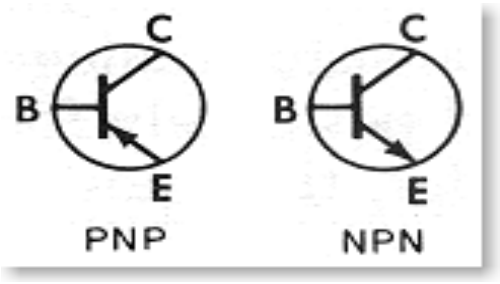
h) State necessity of power supply **(Marks Allotted – 2)**

Necessity of power supply:

A **power supply** is a device that supplies electric power to an electrical load.

A regulated power supply is one that controls or regulates the output voltage or current to a specific value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supply's energy source.

i) Draw neat symbol of NPN and PNP transistor. **(Marks Allotted – 1 Mark for each symbol)**



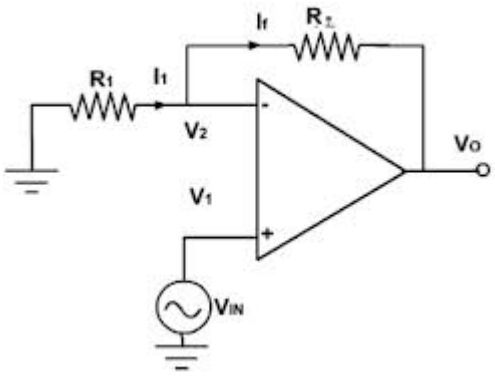
j) What is amplifier? Name active component used in amplifier **(Marks Allotted – 2)**

An electronic **amplifier**, **amplifier**, or (informally) **amp** is an electronic device that increases the strength (power, current, voltage) of a signal.

Active components in amplifier- BJT (NPN or PNP transistor) ,FET

k) Draw neat circuit diagram of non inverting amplifier using opamp. (Marks Allotted – 2)

Non inverting amplifier-

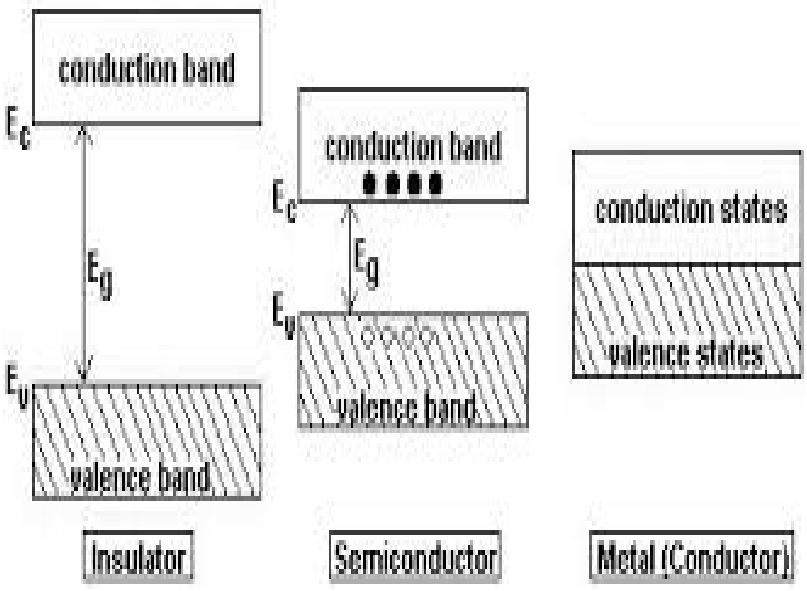


Q-5 Attempt any Four of the following

a) Draw energy level diagram of conductor, semiconductor and insulator.

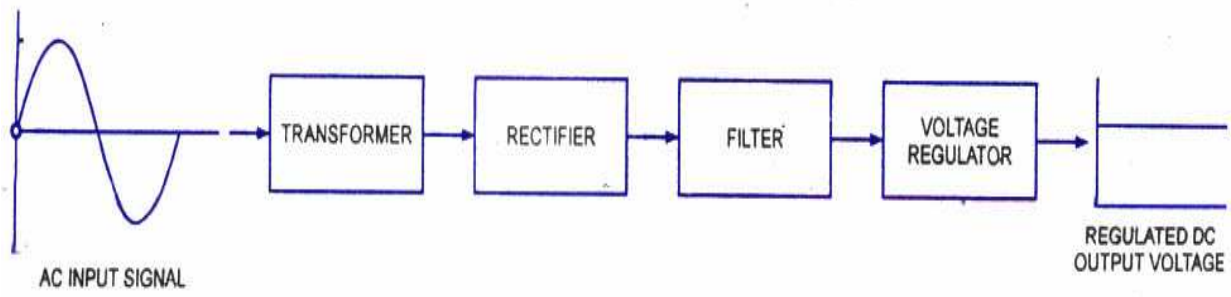
(Marks Allotted –4 Mark)

Energy diagram for conductor, insulator & semiconductor-



b) Draw block diagram of power supply and describe its function. (Marks Allotted –4 Mark)

Block Diagram of power supply: (2 marks)



Block Diagram of a DC Power Supply

Function of power supply- (2 marks)

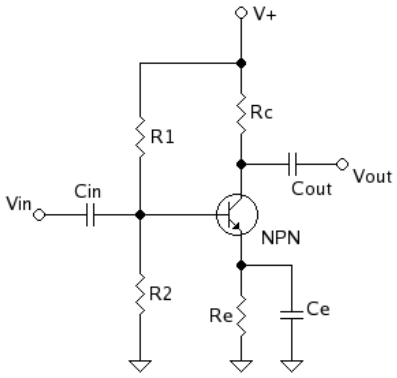
A power **supply** is a device that supplies electric power to an electrical load.

A regulated power supply is one that controls the output voltage or current to a specific value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supply's energy source.

1) Transformer converts 230 V /50 Hz mains input into 12/18/24 V ac signal. Normally, it is step- down transformer.
2) Rectifier converts ac into dc. Rectifiers are of half wave, full wave or Bridge type.
3) Filter removes ripple from rectified output , so that output voltage is pure dc voltage.
4) Voltage regulator regulates the output voltage which is constant irrespective of change in load or input condition.

C) Draw single Stage CE amplifier and describe its working. **(Marks Allotted –4 Mark)**

Single stage CE amplifier- **(1 Mark)**



Transistor Q is configured in common emitter mode to design a voltage Amplifier. Small ac input Vin which is to be amplified is applied at the base of Q. Emitter is common(ground) and output is obtained at the collector of Q. As the transistor is NPN, +Vcc supply is applied as the biasing voltage.

WORKING :- **(2 Marks)**

- Resistors R1 & R2 form voltage divider biasing .
- R1, R2 & RE (emitter resistor) are used to bias the transistor in the active region, because for operating the transistor as an amplifier it is necessary to bias it in the active region.
- Rc – collector resistor is used to control the collector current.
- C1= Input coupling capacitor
- C2=Output coupling capacitor
- CE = Emitter bypass capacitor.

1. In the absence of ac input, IB=IBQ, IC = ICQ, VCE = VCEQ. The Q point is selected in the active region of transistor.
2. As Vin is applied, the base current varies above and below IBQ .
3. Hence Ic =βIB varies above and below ICQ. Variation in Ic is large.
4. Therefore voltage across Rc varies. VRC = Ic x Rc.

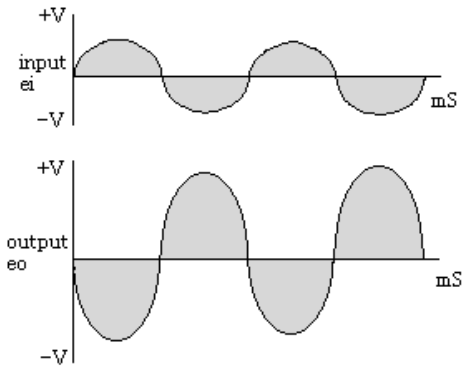
5. Hence collector voltage Vc varies above and below VCE_Q

   as Vc = Vcc- Ic .Rc.

6. Through C2 only the ac part of Vc is coupled to the load. Vo is of same shape as Vin but of larger size.

   Thus amplification has taken place. Vo is also 180 degree phase shifted with Vin.

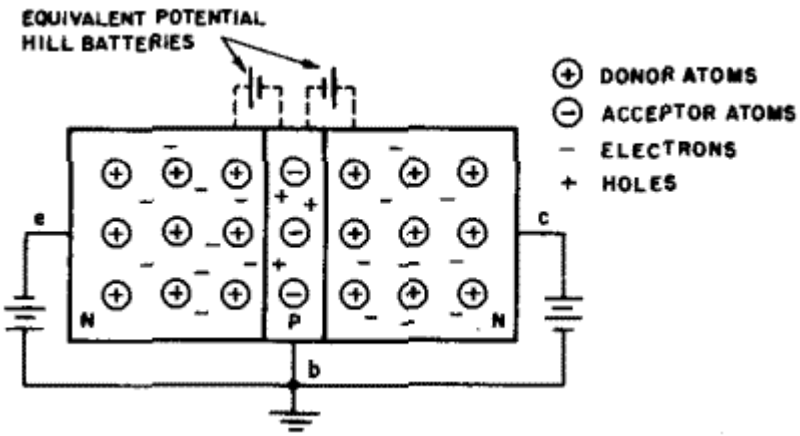
WAVEFORMS :- **(1 Mark)**



d) Describe operation of NPN transistor.

(Marks Allotted –1 mark for diagram and 3 Marks for operation)

Operation of NPN transistor-

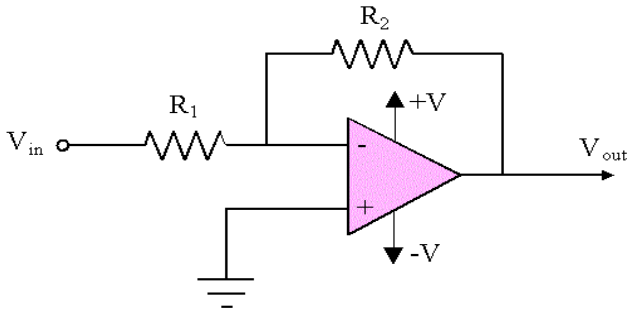


N-p-n transistor is made by sandwiching thin layer of p-type semiconductor between two layers of n-type semiconductor. It has three terminals - Emitter, Base and collector. The npn transistor has two supplies, one is connected through the emitter base and one through the collector base. The supply is connected such that emitter-base are forward biased and collector base are reverse biased. It means, Base has to be more positive than the emitter and in turn, the collector must be more positive than the base. The current flow in this type of transistor is carried through movement of electrons. Emitter emits electrons which are pulled by the base as it is more positive. This end up in the collector as it is more positive. In this way, current flows in the transistor.

Transistor can be used as an amplifier, a switch etc.

e) Draw neat diagram of inverting amplifier using opamp. State relationship between input and output voltage. **(Marks Allotted –4 Mark)**

Inverting amplifier using Op-amp. Circuit Diagram :- **(2 Mark)**



Working: **(2 Mark)**

Here the Op-amp is configured in inverting mode. Input signal Vs is applied at inverting terminal through Resistor $\mathbf{R_1}$ & Non-inverting terminal is grounded $\mathbf{R_f}$ is the feedback resistor.

At node V2, apply kirchoff's current law:-

Ii = Ib + If, But Ib = 0 then Ii ≈ If

$$\frac{Vin - V2}{R1} \equiv \frac{V2 - V0}{Rf} \ldots\ldots\ldots 1$$

As V1 = 0 (grounded) & Vd = 0 …… Ad = ∞

Vd = V1-V2 = 0 Hence V2 = 0…… Virtual ground

Put V2 = 0 in equation **1**

$$\frac{Vin-0}{R1} \equiv \frac{0-V0}{Rf} \qquad \frac{Vin}{R1} \equiv \frac{-VO}{Rf}$$

$$\frac{Vin}{Vin} \equiv \frac{-RF}{R1} \equiv Av$$

Thus the gain of inverting Amplifier is:- $\frac{-Rf}{R1}$

Thus the output gets inverted and amplified.

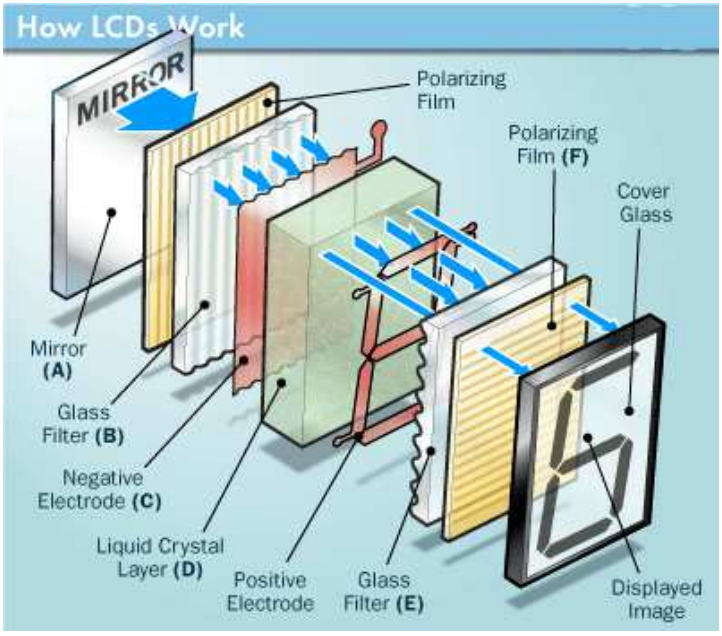
f) Describe operating principle of LCD.

(Marks Allotted – 2 Marks for diagram and 2 – Marks for operation)

Working of LCD-

Basics of LCD Displays:-

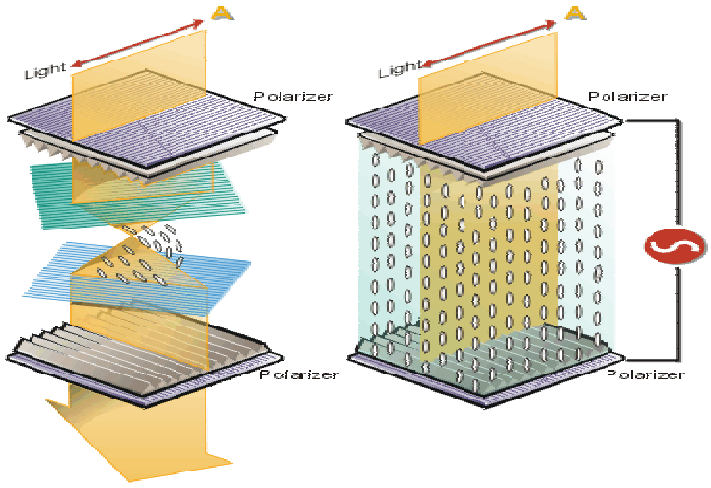
The liquid-crystal display has the distinct advantage of having a low power consumption than the LED.



Working:-

For making an LCD screen, a reflective mirror has to be setup in the back. An electrode plane made of indium-tin oxide is kept on top and a glass with a polarizing film is also added on the bottom side. The entire area of the LCD has to be covered by a common electrode and above it should be the liquid crystal substance. Next comes another piece of glass with an electrode in the shape of the rectangle on the bottom and, on top, another polarizing film. It must be noted that both of them are kept at right angles. When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a temporary battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. Thus that particular rectangular area appears blank.

OR



Working:

The source of light produces a light.

The light passes through a liquid crystal , its intensity is influenced by other layers , especially by liquid crystal.

The flow of light is controlled by the voltage applied to the liquid crystal.

According to the voltage applied , the structure of the liquid crystal rotates (different angle for different pixels).

Thus for each pixel , different amount of light passes through the liquid crystal.

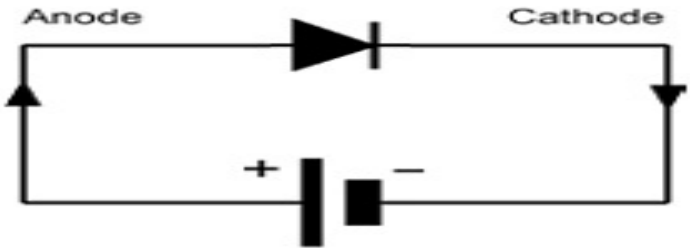
The electrode on the side of screen is common for all pixels.

Q.6 Attempt any Four of the following.

a) Draw forward and reverse bias condition of PN junction diode. Draw VI Characteristics.

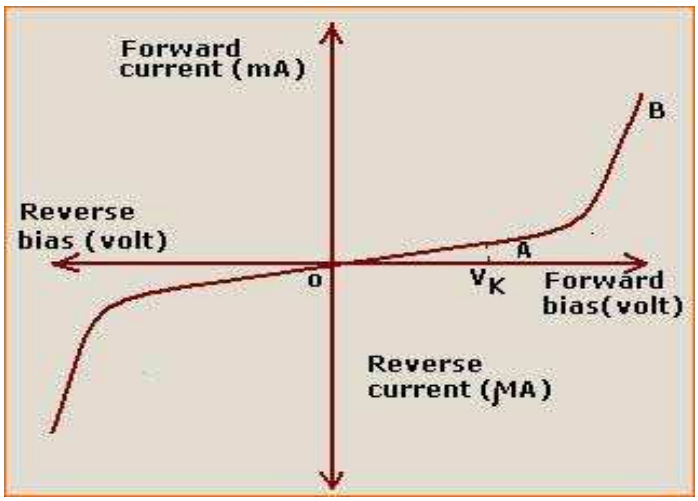
(Marks Allotted –4 Mark)

Working of Diode when Forward Biased:- (2 Marks)



When anode of the diode is connected to the +ve terminal of the dc supply and the cathode is connected to the –ve terminal, the diode is said to be Forward biased. When sufficient forward voltage is applied, the electrons from N region move towards the P region and the holes in the P region also move towards the N region. Due to this the barrier potential at the P-N junction goes on decreasing and finally becomes zero. Then the electrons from N region can cross the junction and recombine with the holes in the P region. Thus the forward current (IF) start to flow through the diode from anode to cathode. The minimum forward voltage at which the current(IF) starts to increase rapidly is called knee *voltage*. After this, the voltage drop across the diode remains constant and the current goes on increasing if the supply voltage is increased.

VI Characteristics:-



Working of Diode When Reverse Biased : **(2 Marks)**

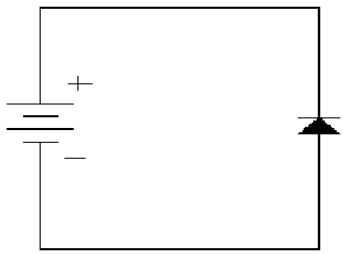


FIGURE2 REVERSED BIASED DIODE

When anode of the diode is connected to the -ve terminal of the dc supply and the cathode is connected to the +ve terminal, the diode is said to be Reverse biased.

With reverse supply voltage the potential barrier at the junction increases. Hence no electron from N region can cross the junction to recombine with the holes in P region. The majority carriers move away from the junction, increasing the width of depletion region. Therefore no current can flow through the diode.

However, in reverse biasing the minority carriers i.e. the holes in N region and electrons in P region recombine at the junction and hence a small amount of reverse current (IR) flows through the diode. This reverse current is very small in terms of a few microamperes. If reverse bias voltage increased excessively, the reverse current will increase sharply which may damage the diode.

b) Describe operation of full wave rectifier using two diodes and centre tap transformer.

(Marks Allotted –1 Marks for diagram , 2 Marks for operation and 1- Mark for waveforms)

Working:-

When input ac supply is switched on, the ends M and N of the transformer secondary become +ve and -ve alternately. During the positive half-cycle of the ac input, terminal M is +ve, G is at zero potential and N is at –ve potential. Hence, being forward-biased, diode D_1

conducts (but D2 is reversed-biased) and current flows along MD_1CABG. As a result, positive half-cycle of the voltage appears across R_L.

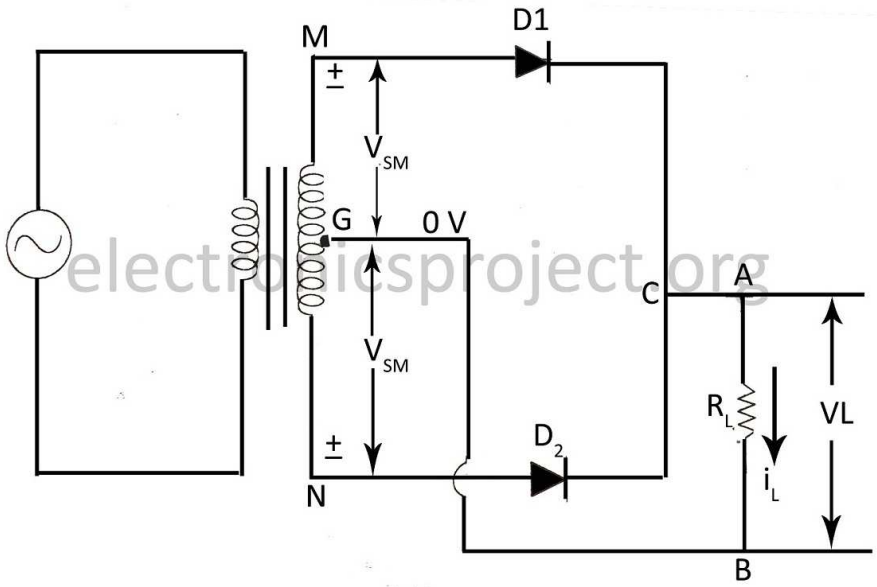


Figure 1-1: single-phase center-tap full-wave rectifier

During the negative half-cycle, when the terminal N becomes +ve, then D_2 conducts (but not D_1) and current flows along ND_2CABG. So, we find that the current keeps on flowing through R_L in the same direction (i.e. from A to B) in both half-cycles of ac input. It means that both half-cycles of the input ac supply are utilized as shown in figure 1-2. Also, the frequency of the rectified output voltage is twice the supply frequency. Of course, this rectified output consists of a dc component and many ac components of diminishing amplitudes.

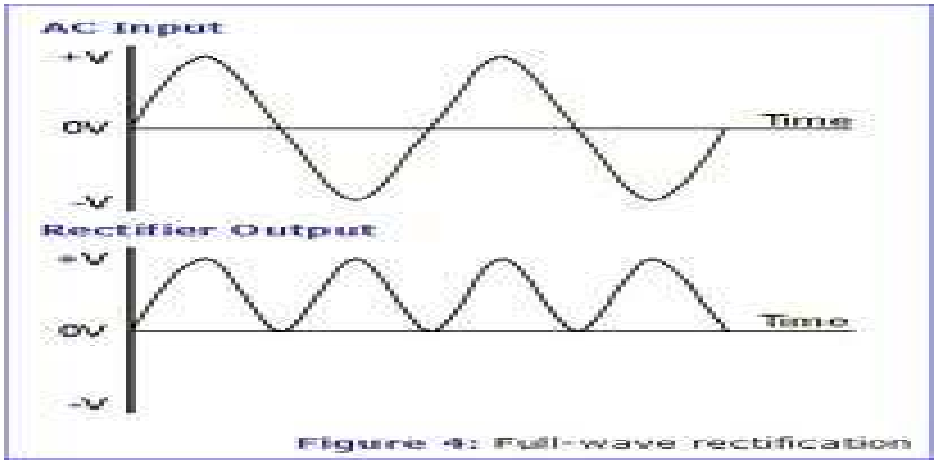
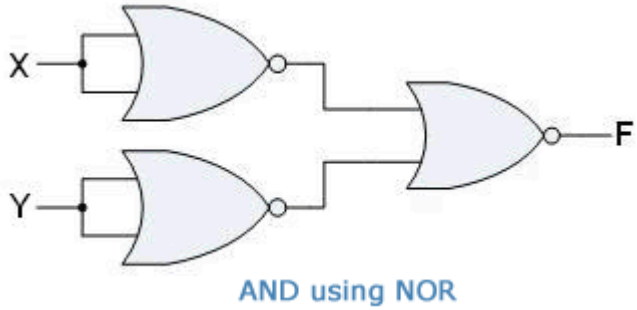


Figure 4: Full-wave rectification

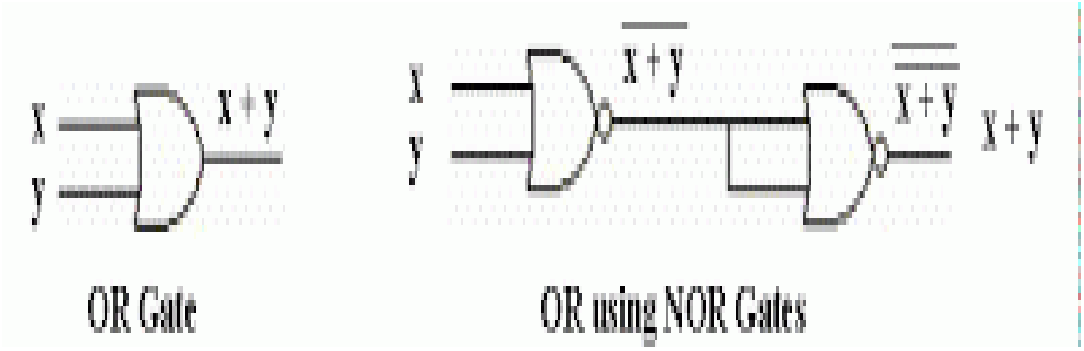
.

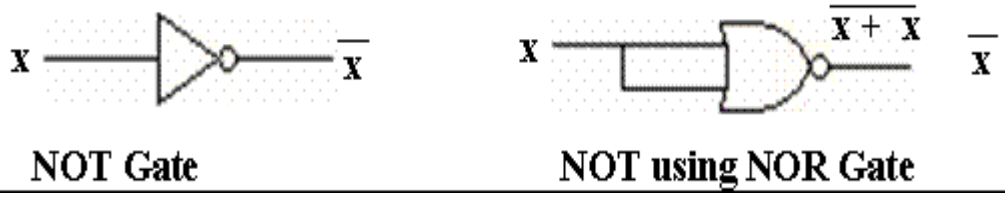
C) Construct OR, AND and NOT gate using NOR gate

(Marks Allotted –2 Mark for AND gate, 1 Mark each for OR and NOT gate)



AND using NOR





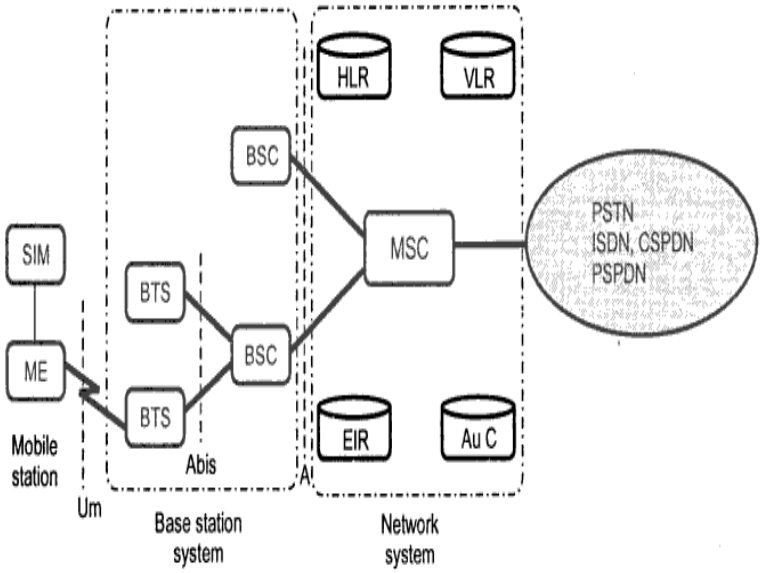
d) Draw block diagram of mobile Phone system. **(Marks Allotted –4 Mark)**

Blocks involved in the mobile phone system/ communication- **(2 Marks for Description)**

- SIM: Subscriber Identity Model
- ME : Mobile equipment
- BSC: Base Station Controller
- BTS: Base Transreceiver Controller
- EIR: Equipment Identity Register

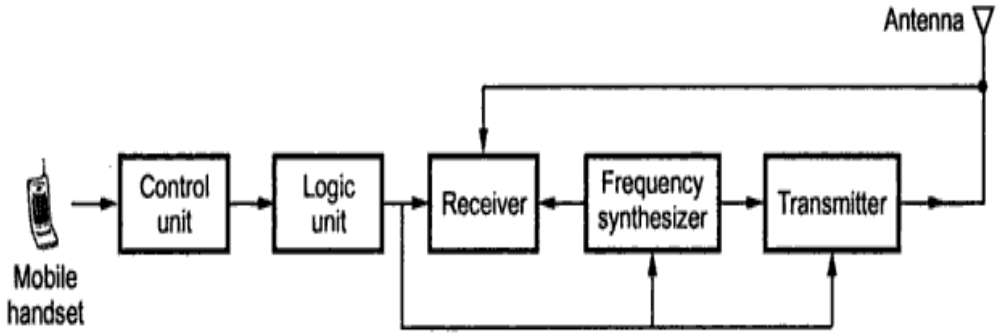
- HLR: Home Location Register
- VLR : Visitor Location Register
- MSC: Mobile Service Switching Centre
- Au C: Authentication centre
- **Mobile Station-** carried by subscriber
- **Base station system-** controls the radio link with the mobile station
- **Network System-** Performs switching of calls between users.
- Mobile phone communication system provide terminal mobility
- (Ability to locate and identify a mobile terminal as it moves and access communication), personal mobility (to identify end users) and service portability (to provide subscribed services).

Block diagram of mobile phone system :- **(2 Marks)**



OR (Alternative Answer)

Block Diagram of mobile phone handset :- **(2 Marks)**



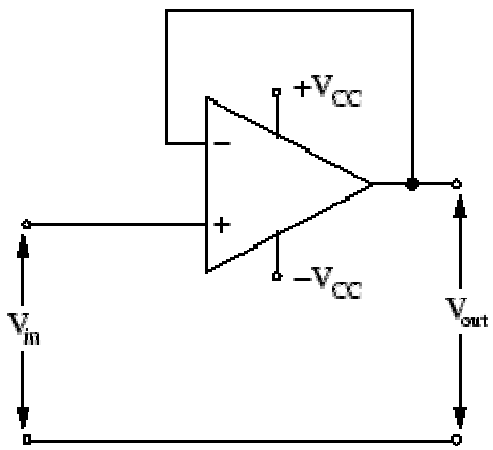
Working :- **(2 Marks)**

- After authentication at mobile terminal and BSC/BTS, the channels are allocated to mobile terminal.
- These channels are accessed by setting frequencies at frequency synthesizer.
- Modulated signal are transmitted and received by allocating different codes to different users, so that the particular user will receive valid signals. This is called as Code Division Multiple Access (CDMA).
- The control and logic units provide required signals for transmission and reception of signal at mobile terminal.

e) What is voltage follower circuit? Give expression of output voltage. State its applications

(Marks Allotted –4 Mark)

Voltage follower using OP-AMP Circuit diagram : **(2 Marks)**



The circuit of voltage follower is the special case of non- inverting amplifier with unity gain. The circuit is also known as unity gain amplifier.

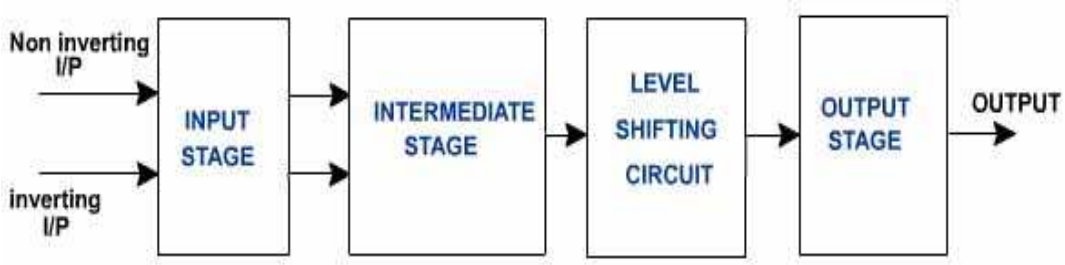
$V_{out} = V_{in}$ --------- **(1 Mark)**

Applications of voltage follower: **(1 Mark)**

1. As a buffer amplifier
2. For impedance matching

f) Draw neat block diagram of operational amplifier. State function of level shifter block.

(Marks Allotted –2 Marks for block diagram and 2 – Marks for function of level shifter)



A level shifter placed in between intermediate stage and output stage. It shifts the DC level back to zero volts (or close to it as required by the design), so that the overall DC path is maintained (input to output).

---------- END ----------