Important suggestions 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.

Q.1 A)	**Attempt any FIVE of the following :** **20 Marks**
a)	**Define the following terms related to AC quantity :** **(i) Instantaneous value (ii) RMS value (iii) Time period (iv) Frequency**
Ans	**i) Instantaneous value:** **(1 Mark)** The instantaneous value is "the value of an alternating quantity (it may ac voltage or ac current or ac power) at a particular instant of time in the cycle". OR The value of alternating quantity (emf, voltage or current) at any particular instant is called the instantaneous value. **ii) RMS value:** **(1 Mark)** The r.m.s value of an alternating current is that steady current (d.c) which when flowing through a given resistance for a given time produces the same amount of heat as produced by the alternating current when flowing through the same resistance for the same time. **OR** $\therefore$ RMS Value = Form Factor $\times$ Average Value **OR** RMS Value = $0.707 \times$ maximum value **iii) Time period:** ----------**(1 Mark)** The time (in sec) required by an alternating quantity to complete its one cycle is known as time period. **iv) Frequency :** **(1 Mark)** The total number of cycles per second. (Hertz)

b) Compare conductor and insulator for two points.

Ans **Compare between conductor and insulator:** **(Any Two expected: 2 Mark each)**

S.No	Conductor	Insulator
1	The conductivity of conductor is very high.	The conductivity of insulator is very low.
2	It has very low resistivity.	It has very high resistivity.
4	Conductor has positive temperature coefficient of resistance.	Insulator has negative temperature coefficient of resistance.
3	There is large number of free electrons available for conduction.	There is small number of electrons available for conduction.
4	Low electronegativity	High electronegativity
5	Valence electrons are less than 4	Valence electrons are more than 4
6	Examples: Aluminum, copper. Silver ,gold.	Examples: Paper, Mica glass, Rubber.
7	Resistance of ideal conductor is zero	Resistance of ideal insulator is infinite.

c) State the significance of colour code in automobile electric wiring.

Ans **Importance of colour coding in automobile wiring:** **(4 Mark)**

Automobile wiring is complicated because of number of lamps and accessories for this color coding is necessary due to which wiring can easily identify for specific lamp and accessories and also it is easier during maintenance.

OR

With the help of color codes of electrical wires, they can be easily and safely identified.

There are some safety measurements that are to be followed while dealing with electrical wiring and the color codes of wires will help in implementing those safety measurements.

colour coding is provided with the automobile wiring harnesses for fault diagnosis and repair works.

The colour coding will identifies the part of circuit formed by this cable

d) Draw the symbols of (i) LDR (ii) Multicell - Battery (iii) Dual filament bulb (iv) Speaker

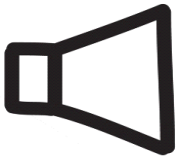
Ans **Symbols :** **(1 Mark each)**

1) LDR

2) Multicell-Battery

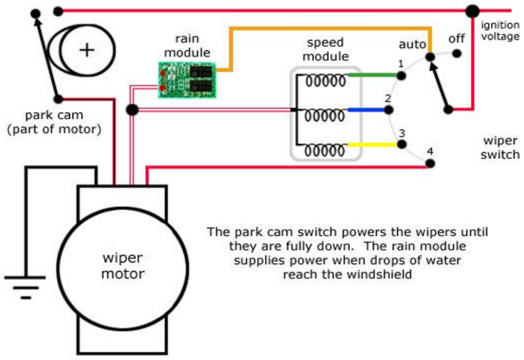
3) Dual filament bulb

4) Speaker



e) Draw wiring diagram of wind shield wiper. Describe how the speed of wiper is adjusted.

Ans **Diagram of Windshield wiper:-** **(2 Marks)**



or any equivalent

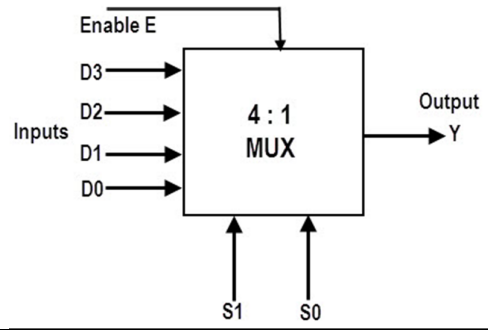
Reason speed is controlled in wiper:- **(2 Marks)**

The ignition switch supplies electrical power for the wiper motor. Current passes through the wiper control switch and then to the wiper motor. A speed control module may vary the voltage that reaches the motor on some models. Other types use different windings in the motor to control speed.

Within the wiper-motor is another switch, with voltage that bypasses the off-switch. The motor times this device with the full down position. Many use a cam to open the circuit when the motor achieves wiper parking. Turn off the wiper switch and current continues to flow through the park-switch, until the wipers are fully down.

f) State meaning of multiplexer. Draw a schematic of 4 to 1 Line multiplexer

Ans **Multiplexer:** is the device which selects one input out of many and connects it to output. **(4 Mark)**



g) Draw the symbols and truth table for two input NAND and NOR gate.

Ans **(Symbols- 2 Marks & Truth Tables-2 Marks)**

NAND gate

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

NOR gate

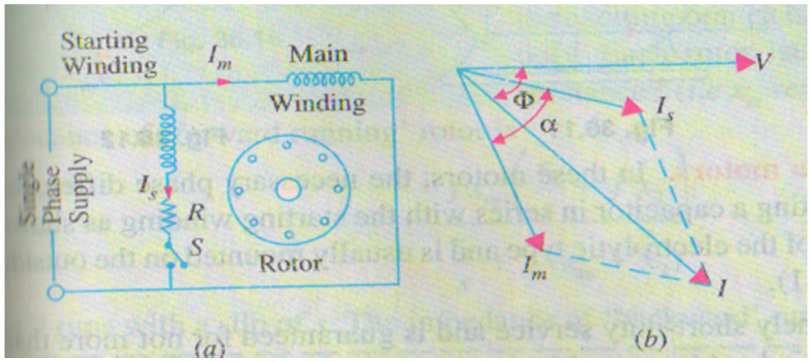
A	B	Output
0	0	1
0	1	0
1	0	0
1	1	0

Q.2 Attempt any FOUR of the following : 16 Marks

a) Write working principle and applications of resistance split phase motor.

Ans: **(Diagram: 1 Mark & Working: 2 Mark, Application: 1 Mark)**

Circuit diagram of resistors split single phase induction motor:



or equivalent figure

Operation of resistors split single phase induction motor:

- In resistors split phase I.M shown in above figure 'a', the main winding has low resistance but high reactance whereas the starting winding has a high resistance, but low reactance. The phase difference between current in both windings causes rotating magnetic filed causing rotor to rotate.
- The resistance of the starting winding may be increased either by connecting a high resistance 'R' in series with it or by choosing a high-resistance fine copper wire for winding purpose**.**
- A centrifugal switch S is connected in series with the starting winding and is located inside the motor.
- It function is to automatically disconnected the starting winding from the supply when the motor has reached 70 to 80 per cent of its full load speed.

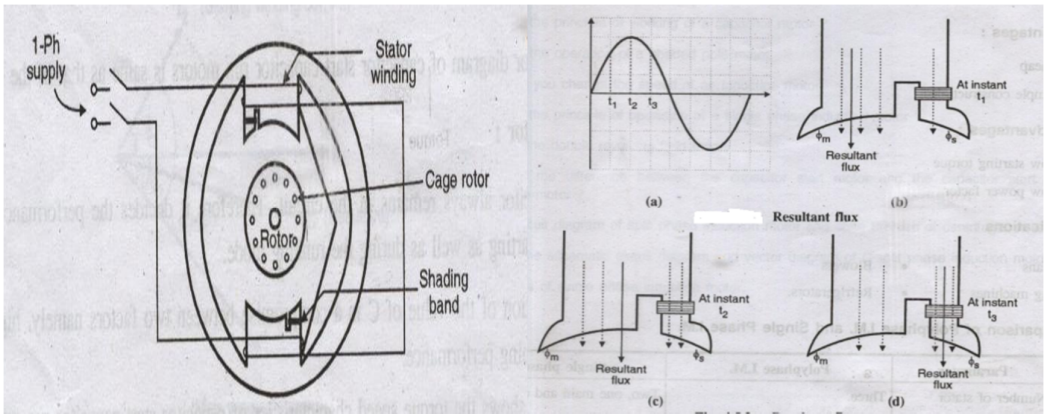
Applications of resistance Split Phase Induction Motor :

(Any Two expected: 1/2 Mark each)

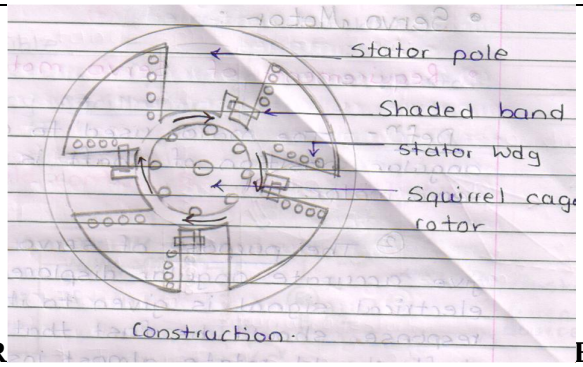
1. washing machine
2. Air conditioning fans.
3. Mixer grinder
4. floor polishers.
5. Blowers
6. Centrifugal pumps
7. Drilling and lathe machine.

b) Describe the working principle of shaded pole motor.

Ans: **i) Shaded Pole Induction Motor :** **(Figure-2 Mark & Explanation: 2 Mark)**



or



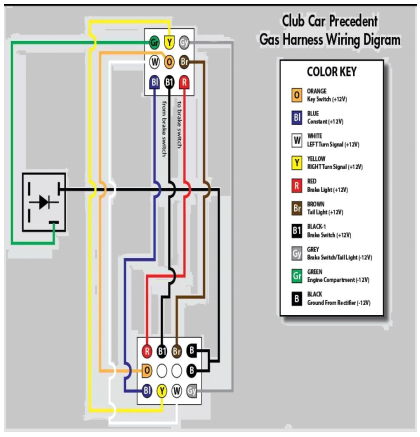
OR Equivalent Fig.

Construction & Working:-

When single phase supply is applied across the stator winding an alternating field is created. The flux distribution is non uniform due to shading coils on the poles.

Now consider three different instants of time t_1, t_2, t_3 of the flux wave to examine the effect of shading coil as shown in the fig above. The magnetic neutral axis shifts from left to right in every half cycle, from non shaded area of pole to the shaded area of the pole. This gives to some extent a rotating field effect which may be sufficient to provide starting torque to squirrel cage rotor.

c)	**Describe the harness of wiring and cable connector with diagram.**
Ans:	**i) Function of wiring harness:** **(Figure: 1 Mark & Function: 1 Mark)**

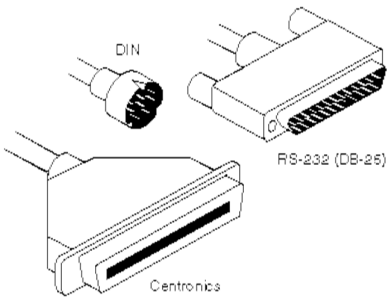


or equivalent figure

Automobile wiring is complicated and critical to setup, with the help of harness time required for completion of wiring is less it easy to replace and maintain other accessories

like audio, video or mobile can be setup inside the vehicle, with proper instructions it can be easily installed and replace safely.

Cable connectors: **(Figure: 1 Mark & Function: 1 Mark)**



Function of cable connector:

The part of a cable that plugs into a port or interface to connect one device to another. Most connectors are either male *or* female types.

d) Describe self inductance and mutual inductance.

Ans:

i) Self induced emf : **(2 Mark)**

Self-induced emf is the e.m.f induced in the coil due to the change of flux produced by linking it with its own turns. This phenomenon of self-induced emf

$$e \alpha \frac{dI}{dt} or \quad e = L \frac{dI}{dt}$$ **OR**

In the Statically induced emf flux linked with coil or winding changes (dΦ/dt) and coil or winding is stationary such induced emf is called Statically induced emf

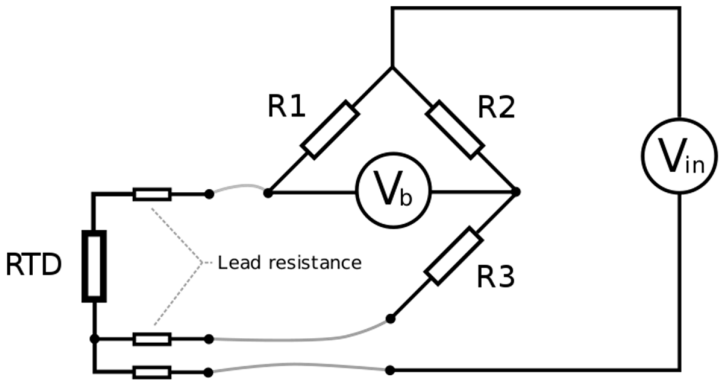
$$E = - N (d\Phi/dt)$$

ii) Mutually induced emf : **(2 Mark)**

The emf induced in a coil due to the change of flux produced by another neighboring coil linking to it, is called **Mutually Induced emf.**

$$e_m \alpha \frac{dI_1}{dt} or \quad e = M \frac{dI_1}{dt}$$

e)	**Draw a'neat labelled diagram of RTD and explain it's operating principle.**
Ans:	**Diagram of RTD operating principle:** **(Diagram: 2 Mark & Principle : 2 Marks)**



RTD is temperature dependent resistance i.e. a resistive sensing element with positive temp coefficient. The resistance is increased with increase in temperature. Platinum is the preferred material. The nominal resistance at room temperature is 100ohm with highly linear and repeatable characteristics of temperature to resistance makes it an ideal choice for temperature measurement in the range of -200 to 500^0C RTDs are always connected in wheatstone bridge circuit with 2/3 wire configuration to produce voltage signal in response to temperature.

f)	**State Fleming's Right hand and Left hand rule**
Ans:	**1) Fleming's Right Hand Rule:** **(2 Mark)**

Arrange three fingers of right hand mutually perpendicular to each other, if the first figure indicates the direction of flux, thumb indicates the direction of motion of the conductor, and then the middle finger will point out the direction of induced current.

Use: Generator. current & EMF

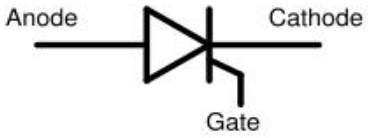
2) Left hand rules: **(2 Mark)**

According to Fleming's left hand rule if we stretch the thumb, the center finger and the middle finger of our left hand such that they are mutually perpendicular to each other. If the center finger gives the direction of current and middle finger points in the direction of magnetic field then the thumb points towards the direction of the force or motion of the conductor.

Use: Electric Motor

Q.3	Attempt any FOUR of the following : 16 Marks
a)	**Draw the symbolic representation of SCR and define (i) Holding current (ii) Breakdown voltage (iii) Forward current rating State Fleming's Right hand and Left hand rule.**
Ans:	**(Symbol-1Mark & Each meaning: 1 Mark)**

Symbolic representation of SCR



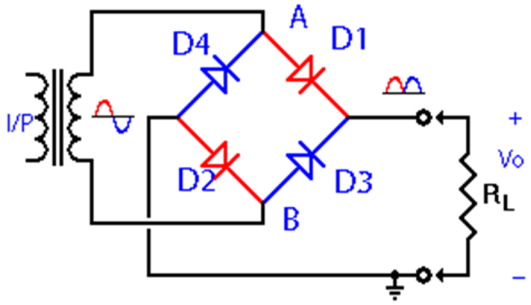
(1) Holding current : It is the minimum anode current required to maintain SCR in the on state.

(2) Breakdown voltage : The voltage at which breakdown of reverse biased junction occurs and current increases uncontrollably.

(3) Forward current rating : The maximum value of anode current, that an SCR can handle safely without any damage, is called the forward current rating.

b)	**Draw the circuit diagram of Bridge full wave rectifier and explain it's operation.**
Ans:	**(Circuit Diagram – 1 Mark, Working – 2 Marks, waveform – 1 Mark)**

Bridge type full wave rectifier:



Working:-

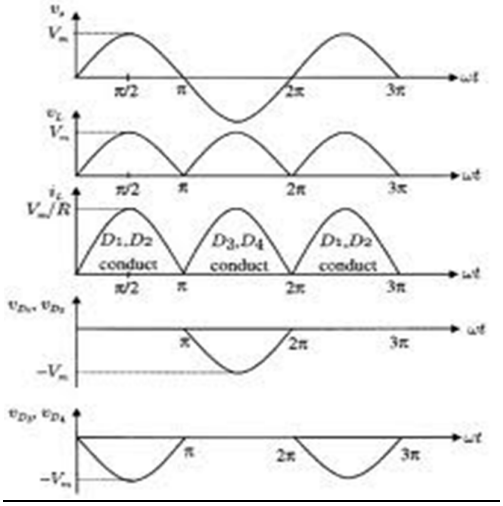
The Bridge rectifier consists of a step down transformer, a rectifier circuit with four diodes and a load resistance RL .

- The 230 V ac input from mains is stepped down (reduced) using the step transformer.
- The reduced ac i.e. output of the secondary of the transformer is applied to the bridge circuit.
- The bridge consists of four diodes D1,D2,D3&D4, which offers full wave rectification. The diodes conduct in pair.
- During +ve half cycle of the ac input, point A is +ve& point B is –ve. Therefore diode D1 & D2 are forward biased and D3 & D4 are reverse biased. Therefore only D1 and D2 conduct and the current flows along the path " A-D1-RL-D2-B".
- During -ve half cycle of the ac input, point B is +ve& point A is –ve. D3 and D4 conduct while D1 & D2 remain reverse biased(off). Therefore the current follows

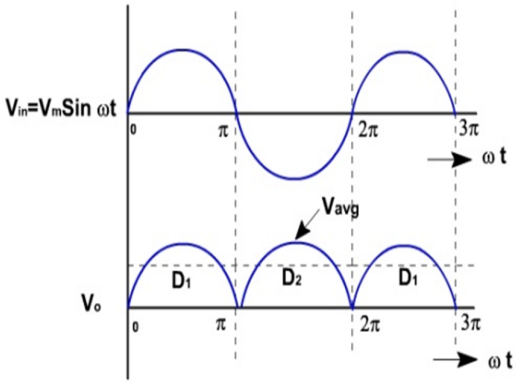
following path“ B-D3-RL-D4-A”.

- In both the cases load resistance conducts in the same direction as shown in the above figure. Thus the ac signal gets converted into dc pulses.

The waveforms are as follows:-



OR



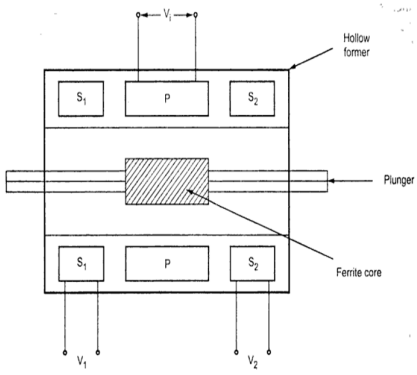
c) Draw the diagram of LVDT and explain the measurement of displacement.

Ans: **Linear Variable Differential Transformer (LVDT):-**

(Figure: 2 Marks & Explanation: 2 Marks)

It is the transducer most widely used to translate linear motion into electrical signals.

Construction-



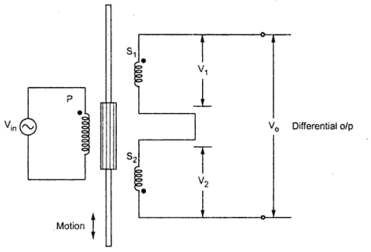
or equivalent dia.

P= primary winding

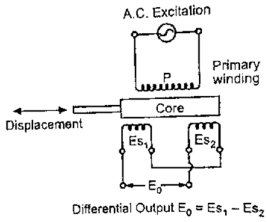
S1, S2= two secondary windings.

Working-

The secondary S1 and S2 are connected in series opposition so that voltages induced in each coil oppose each other. The electrical equivalent connection is shown below.



OR



or equivalent dia.

The position of movable core determines the flux linkage between the primary and each of the secondary windings.

Let V1= output of secondary S1

V2= output of secondary S2

Then V_O= V1-V2

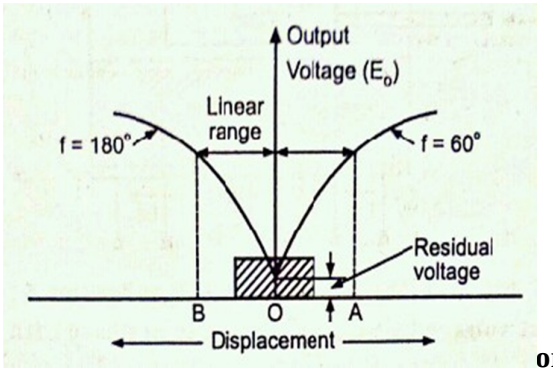
Case 1: when the core is at centre.

With the core in the centre, the induced voltages V1 and V2 in the secondary S1 and S2 are equal, since they oppose each other; the output will be zero volts.

Case 2: when core is displaced.

When the core is displaced from the null position, the induced voltage in the secondary towards witch the core has moved increases while that in other secondary decreases.

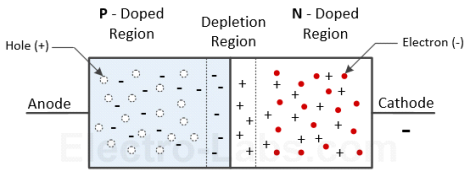
The phase difference between the output and input voltage changes by 180 degrees when the core moves through the null position. Therefore in actual measurement to determine positions uniquely, this phase change over is measured with phase sensitive detector.



or equivalent dia.

d)	**Draw and describe the VI characteristic of P-N junction.**
Ans:	**(2 Mark for working , 2 Marks characteristics)**

Construction of PN junction diode: -



or equivalent figure

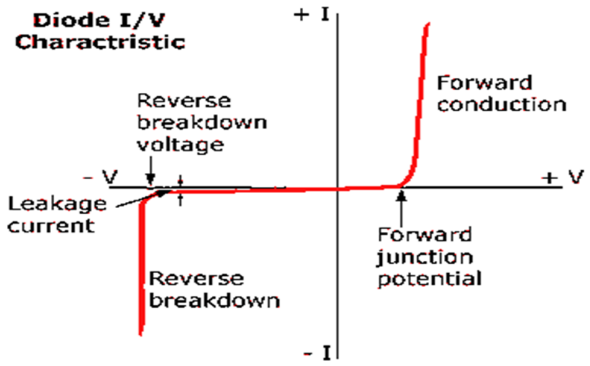
A P-N junction is formed at the boundary between a p-type and n-type semiconductor created in a single crystal of semiconductor by doping.

Working-

In forward bias, the p-type is connected with the positive terminal and the n-type is connected with the negative terminal. With a battery connected this way, the holes in the P-type region and the electrons in the N-type region are pushed toward the junction. This reduces the width of the depletion zone. The positive charge applied to the P-type material repels the holes, while the negative charge applied to the N-type material repels the electrons. As electrons and holes are pushed toward the junction, the distance between them decreases. This lowers the barrier in potential. With increasing forward-bias voltage, the depletion zone eventually becomes thin enough that the zone's electric field cannot counteract charge carrier motion across the p–n junction, as a consequence reducing electrical resistance. The electrons that cross the p–n junction into the P-type material (or holes that cross into the N-type material) will diffuse in the near-neutral region. Therefore, the amount of minority diffusion in the near-neutral zones determines the amount of current that may flow through the diode.

Reverse-bias usually refers to how a diode is used in a circuit. If a diode is reverse-biased, the voltage at the cathode is higher than that at the anode. Therefore, no current will flow until the diode breaks down. Connecting the P-type region to the negative terminal of the battery and the N-type region to the positive terminal corresponds to reverse bias. Because the p-type material is now connected to the negative terminal of the power supply, the 'holes' in the P-type material are pulled away from the junction, causing the width of the depletion zone to increase. Likewise, because the N-type region is connected to the positive terminal, the electrons will also be pulled away from the junction. Therefore, the depletion region widens, and does so increasingly with increasing reverse-bias voltage. This increases the voltage barrier causing a high resistance to the flow of charge carriers, thus allowing minimal electric current to cross the p–n junction. The increase in resistance of the p–n junction results in the junction behaving as an insulator.

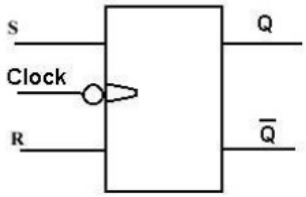
VI Characteristics:



or equivalent figure

e) Draw the symbols of RS flip flop and D flip flop. Write their truth table.

Ans: **1) Symbol & Truth Table of RS flip flop :** **(2 Marks)**



Symbol

(b) *SR* Flip-Flop

S	R	$Q(t+1)$	Operation
0	0	$Q(t)$	No change
0	1	0	Reset
1	0	1	Set
1	1	?	Undefined

Truth Table

2) Symbol & Truth Table of D flip flop : **(2 Marks)**

The D type flip-flop has one data input 'D' and a clock input. The circuit edge triggers on. The clock input. The flip-flop also has two outputs Q and Q' (where Q' is the reverse of Q).

D Flip-flop

Symbol

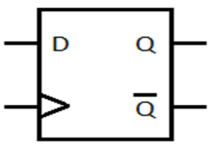
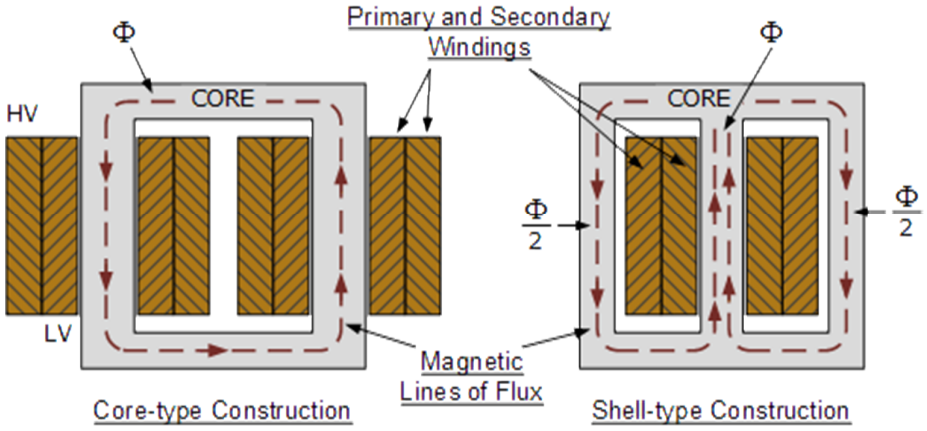


Table of truth:

clk	D	Q	$\overline{Q}$
0	0	Q	$\overline{Q}$
0	1	Q	$\overline{Q}$
1	0	0	1
1	1	1	0

f)	**State working principle of single phase transformer**
Ans:	**Single phase transformer :** **(2 Marks)**



Working Principle: - ---------- **(2 Marks)**

- The primary winding is connected to single phase AC supply. an ac current starts flowing through it.
- The AC primary current produces an alternating flux in the core.
- This Changes flux gets linked with the secondary winding through the core
- The varying flux will induce voltage into the secondary winding according to the faraday's laws of electromagnetic induction.
- The induced voltage value is determine by Faraday's Law.

$$E_{Rms} = 4.44 * f * \Phi * N$$

Where,

f → frequency Hz

N → number of winding turns

Φ → flux density Wb

OR

A Transformer works on the principle of Faradays law of electromagnetic induction. When their primary winding is connected to a.c supply, applied alternating voltage circulates an alternating current through it.

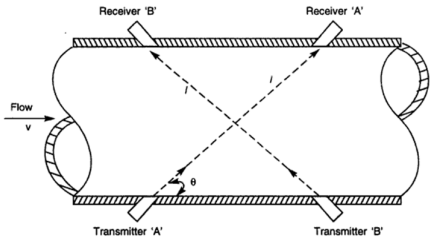
This current flowing through the primary winding produces an alternating magenetic flux (Ø).This flux links with secondary winding through the magenetic core & induces an emf in it according to the faraday's laws of electromagnetic induction.

Q.4	Attempt any FOUR of the following : 16 Marks
a)	**Draw a neat diagram of ultrasonic flowmeter and describe it's working.**

Ans: **(Diagram- 2 Marks & Working Principle-2 Marks)**

➢ **Ultrasonic flow meter Schematic diagram:-**

There are two types based on – 1) Doppler effect 2) Transit time.



or equivalent dia.

Working- Ultrasonic flow meter based on Doppler effect is explained here.

A and B are piezo-electric devices transmitting the short duration ultrasonic signals through the fluid that is flowing through the pipe at a velocity v. Similar type of crystals are used as receivers to respond to pressure fluctuations.

Due to the fluid velocity v aiding the transmission, the velocity of ultrasonic signal from the transmitter-A to receiver-A is increased to a value c + v cos θ, where c is the velocity of sound through the fluid in the pipe and θ is the angle between the path of sound and the pipe valve. The repetition frequency of the received pulse f_A will be

$$f_A = \frac{c + v\cos\phi}{l}$$

Where l= the distance between the transmitter and receiver.

On the other hand, the velocity of the ultrasonic signal transmitted by transmitter B and received by received B will be reduced by the fluid velocity causing a retardation of v cos θ and its pulse repetition frequency f_B will be

$$f_B = \frac{c - v\cos\phi}{l}$$

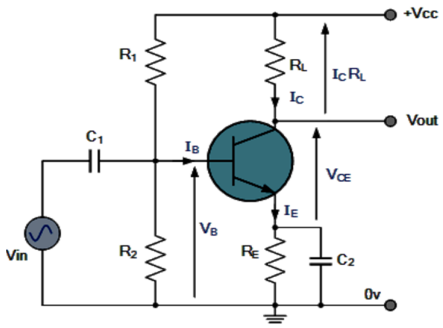
The difference between frequencies is given by

$$\Delta f = f_A - f_B = \frac{2v\cos\phi}{l}$$

By measuring the difference in the repetition frequency Δf and knowing the values of θ and l, the velocity of the fluid can be computed alternatively, the flow velocity can be computed by measuring the transit time difference between the two pulse trains in either direction.

b) Describe the working of transistor as an amplifier.

Ans: **Diagram :** **(2 Marks for diagram and 2 Marks for explanation)**



or equivalent fig

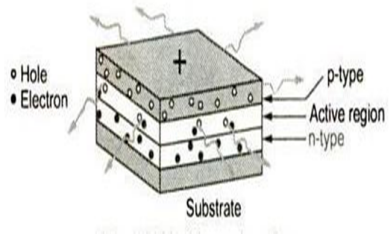
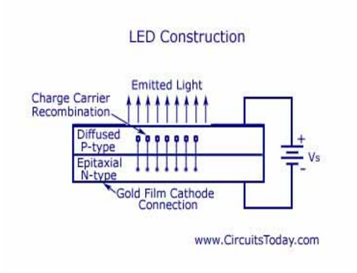
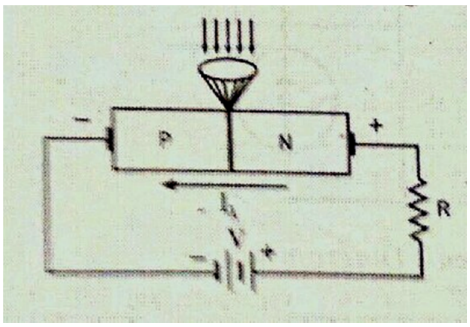
Explanation : :-

Transistor 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 transistor. 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 :-

- 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.
- Cc1 = Input coupling capacitor
- Cc2 = Output coupling capacitor
- Ce = Emitter bypass capacitor.

1. In the absence of ac input, $I_B=I_{BQ}$, $I_C = I_{CQ}$, $V_{CE} = V_{CEQ}$. The Q point is selected in the active region of transistor.
2. As Vin is applied, the base current varies above and below I_{BQ} .
3. Hence Ic =βI_B 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 C out 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.

c)	**Describe the working of LED with neat diagram.**
Ans:	**(Diagram - 2 Marks, Working principle- 2 Marks)** **Diagram light emitting diode :**  or  **Working of LED (**LED- Light Emitting Diode) : ➢ When it is forward bias, it emits visible light. The electrons are in the higher conduction band on the N-side, where holes are are in the lower valence band on p- side. ➢ When forward biased electrons recombine with the holes. During recombination energy is emitted in form of light. ➢ G_aA_s, G_aP, G_aA_sP are used to get visible light.(G_aA_S- Infrared radiation, G_aP- Red or green, G_aA_sP- Red or yellow Colors of the emitted light depend on the type of material used.
d)	**Draw the symbol of photodiode. Describe it's working and give any two applications.**
Ans:	**(Symbol : 1 Mark, Working: 1 Mark, Digarm: 1 Mark & Application: 1 Mark)** **Symbol:** **Schematic diagram**   **or equivalent dia.** **Working-** Photodiode is a two terminal semiconductor P-N junction device and is designed to operate with reverse bias. A photodiode is a p-n junction or PIN structure. When a photon of sufficient energy strikes the diode, it excites an electron, thereby creating a free electron (and a positively charged electron hole).

When a reverse biased P-N junction is illuminated, the current flowing through it varies almost linearly with light flux. The output voltage is taken from across a series-connected load resistor R as shown in above figure.

Applications of photodiode:

1. Photo diodes are used in consumer electronics devices such as compact disc players, smoke detectors
2. The receivers for infrared remote control devices used to control equipment from televisions to air conditioners.
3. Light measurement, as in camera light meters, or to respond to light levels, as in switching on street lighting after dark.

e) Define transformation ratio, turns ratio for single phase transformer.

Ans:

i) 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.

OR

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

ii) Turns ratio: ---------- -(2 Marks)

Turns Ratio of a transformer is defined as the ratio of the number of turns in the Primary to the number of turns in the Secondary.

$$Turns\ ratio\ = \frac{N_1}{N_2}$$

f) Describe the concept of stepper motor.

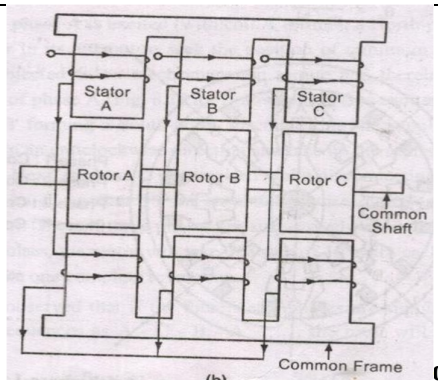
Ans:

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence, the motor will rotate, one step at a time.

Types of Stepper Motor :- (1 Marks)

1) Variable Reluctance Motor
2) Permanent Magnet Motor

1) Variable Reluctance Motors:- (Any one types of Explanation - 2 Mark)



or equivalent dia.

Working:-

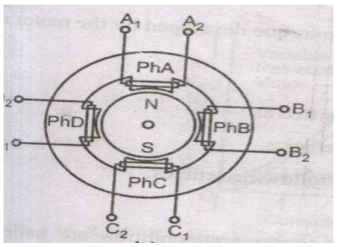
When phase A is excited rotor attempts minimum reluctance between stator and rotor and is subjected to an electromagnetic torque and there by rotor rotates until its axis coincides with the axis of phase A.

Then phase 'B' is excited disconnecting supply of phase 'A' then rotor will move 30 anticlockwise directions. The Same process is repeated for phase 'C'

In this way chain of signals can be passed to get one revolution and direction can be also changed.

OR

2) Permanent Magnet Motor:-



or equivalent dia.

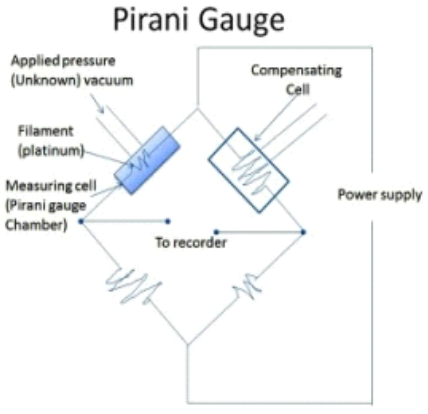
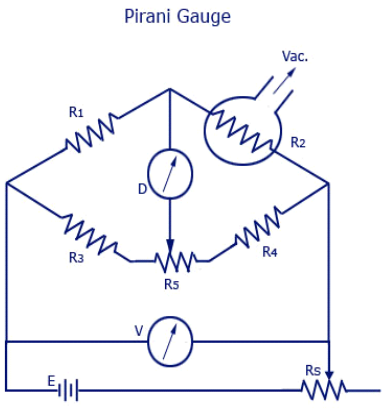
Working :-

If the phase is excited in ABCD, due to electromagnetic torque is developed by interaction between the magnetic field set up by exciting winding and permanent magnet.

Rotor will be driven in clockwise direction.

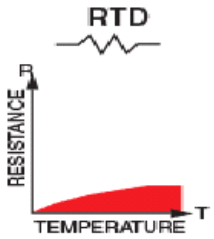
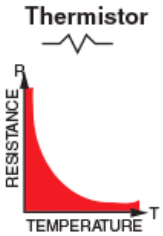
Applications of stepper motor- **(Two application expected-1/2 Mark each)**

1.Suitable for use with computer controlled system
2. Widely used in numerical control of machine tools.
3. Tape drives
4. Floppy disc drives
5. Computer printers
6. X-Y plotters

	7. Robotics 8. Textile industries 9. Integrated circuit fabrication 10. Electric watches 11. In space craft's launched for scientific explorations of planets. 12. In the production of science friction movies 13 Automotive 14. Food processing 15. Packaging
Q.5	**Attempt any FOUR of the following : 16 Marks**
a)	**State the working principle of pirani vacuum gauge with a labelled diagram.**
Ans:	**Principle of pirani vacuum gauge : (Principal: 2 Marks & Diagram: 2 Marks)** The Pirani gauge consists of a metal filament (usually platinum) suspended in a tube which is connected to the system whose vacuum is to be measured. Connection is usually made either by a ground glass joint or a flanged metal connector, sealed with an o-ring. The filament is connected to an electrical circuit from which, after calibration, a pressure reading may be taken. A conducting wire (platinum filament) gets heated when electric current flows through it. This wire suspended in a gas will lose heat to the gas as its molecules collide with the wire and remove heat. As the gas pressure is reduced (by the vacuum pumps) the number of molecules present will fall proportionately, the conductivity of the surrounding media will fall and the wire will lose heat more slowly. Measuring the heat loss is an indirect indication of pressure. **Diagram of pirani vacuum gauge:**  **OR** 

b) State the difference between thermistor & RTD on four points.

Ans: **(Any four points 4 Marks)**

Criteria	RTD	Thermistor
Temperature range	-250°C to +750°C	-100°C to +500°C
Accuracy	Best	Depends on calibration
Linearity	Good	Worst
Sensitivity	Less	Best
Circuitry	Complex	Depends on accuracy/power requirements
Charactesristics		

c) Define the following terms : (i) Intrinsic semiconductor (ii) Extrinsic semiconductor

Ans:

a) Intrinsic semiconductor- **(2 Mark)**

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

b) Extrinsic semiconductor- **(2 Mark)**

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

d) What are positive and negative return system in wiring system ? Compare them.

Ans: **Positive return system:** ---------- **(2 Marks)**

1. Tends to generate excessive system gain, noise, narrows bandwidth, and can cause oscillation.
2. Creates instability and tends to drive a system into its nonlinear region of operation.

3. Whereas negative feedback reduces system gain and increases bandwidth. Positive feedback increases system gain, narrows bandwidth, and becomes unstable. However, a system operating with positive feedback that hasn't gone into complete instability (oscillation), can be a very sensitive device with very high-gain amplifiers and sharp selectivity--super-regenerative radio receiver is a good example

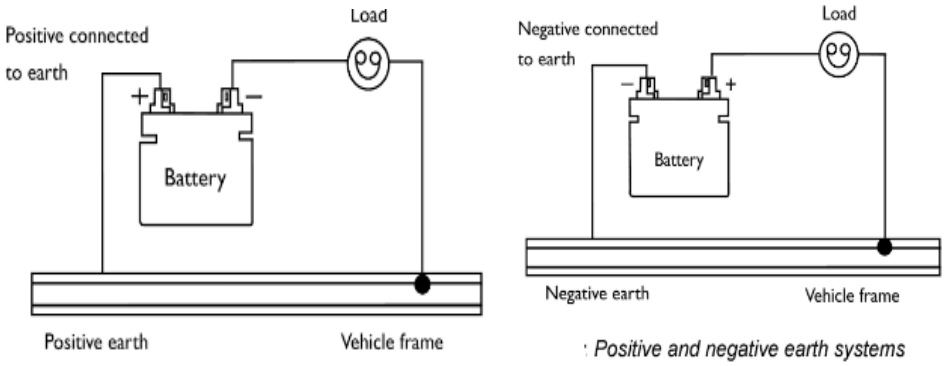
Negative return system: ---------- (2 Marks)

1. Tends to opposite excessive change (large amplitude) and wants to hold a system within a limited operating range.
2. In the case of an amplifier, it tends to reduce circuit gain and increase device operating bandwidth.
3. Tends to create system stability by ensuring linear operation.

OR

(4 Marks)

In positive return systems, negative terminal of battery is connected to different units of automobile and positive is earthed. In negative return system, positive is supplied to units and negative is earthed.



· *Positive and negative earth systems*

e) State Ohm's law. Compare series and parallel circuits for two points.

Ans: **Ohms Law:** ---------- **(State-1 Mark & Equation-1 Mark)**

The current flowing through a solid conductor is directly proportional to the difference of potential across the conductor. & inversely proportional to its resistance provided the temperature remains constant.

Equation:- **i.e** $I \propto V \quad \therefore \frac{V}{I} constant \therefore I = \frac{V}{R}$

$or \ \therefore V = I.R. \quad or \quad R = \frac{V}{I}$

Where R is constant called as resistance, V=voltage and I = Current

Comparison for series and parallel circuits: **(Any Two point expected: 1 Mark each)**

S.No.	Series circuits	Parallel circuits
1	Only ONE path for current to flow in a closed circuit	Number of path for current to flow in a closed circuit
2	Current remains the SAME in all parts of the circuit	Current is DIFFERENT through each branch of the circuit
3	Voltage is DIFFERENT across each component	Voltage remains the same across each component of the circuit
4	Total power supplied is the sum of powers consumed in each circuit components like: P_Total=P_1+P_2+...	Total power supplied is the sum of powers consumed in each circuit components like: P_Total=P_1+P_2+...

f) Describe the working of DC motor.

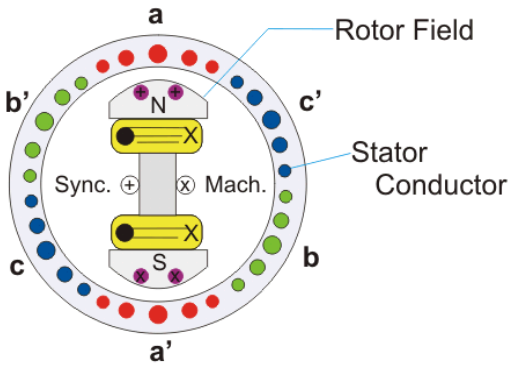
Ans: **Working Principle of D.C Motor :-** **(4 Marks)**

It works on Faradays law of electromagnetic induction -If a current carrying conductor is placed in a magnetic field, mechanical force is experienced on the conductor, the direction of which is given by Fleming's left-hand rule (also called motor rule) and hence the conductor moves in the direction of force.

Q.6	Attempt any FOUR of the following : 16 Marks
a)	**Draw a neat sketch of elementary alternator and name the parts. Explain it's working principle.**

Ans:

Diagram: **(1 Marks)**



Construction of three phase alternator: **(1 Marks)**

Construction wise, an alternator generally consists of field poles placed on the rotating fixture of the machine i.e. rotor as shown in the figure above. In most practical construction of alternator, it is installed with a stationary armature winding. There are mainly two types of rotor used in construction of alternator,

1. Salient pole type.
2. Cylindrical rotor type.

The working principle of alternator *:* **(2 Marks)**

Principle of alternator depends upon Faraday's law of electromagnetic induction. When the field winding gets excited field current flows through the field winding which produces magnetic flux in the air gap. As the prime mover rotates, the field winding also rotates and hence the magnetic flux also rotates.

This rotating magnetic field is cut by the stationary armature conductors. So according to Faraday's law of electromagnetic induction , an EMF is induced in the armature conductors.

b)	**Define the following terms — accuracy, precision, sensitivity and reliability.**

Ans:

i) Accuracy – **(1 Mark)**

It is defined as the difference between the true value and the measured value.

OR

It is the closeness with which an instrument reading approaches the true value of the quantity being measured.

OR

The degree of exactness of a measurement compared to the expected value.

ii) Precision: **(1 Mark)**

describes the reproducibility of the measurement.

OR

It is a measure of the reproducibility of the measurements that is given a fixed value of a quantity, precision of measure of the degree of agreement within a group of measurements.

OR

A measure of the consistency of measurements, i.e successive readings do not defer.

iii) Sensitivity: **(1 Mark)**

Is an absolute quantity, the smallest absolute amount of change that can be detected by a measurement. **OR**

Sensitivity is the ratio of change in output of an instrument to the change in input.

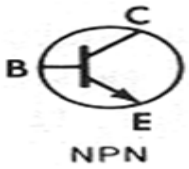
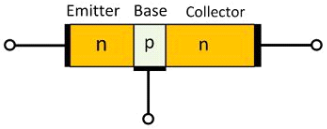
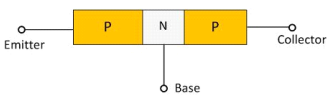
(iv) Reliability: **(1 Mark)**

Reliability is a way of ensuring that any instrument used for measuring experimental variables gives the same results every time. **OR**

Instrument Reliability is defined as the extent to which an instrument ***consistently*** measures what it is supposed to.

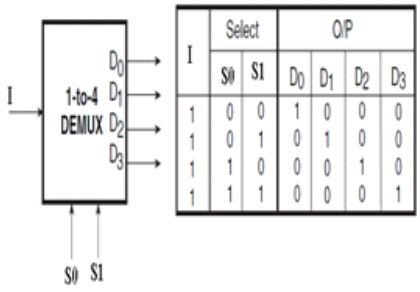
c) Compare PNP & NPN transistor for following points : (i) symbol (ii) construction

Ans: **(Symbol 2 Marks construction 2 Marks)**

Sr.No.	Parameter	NPN transistor	PNP transistor
1	Symbol		
2	Construction		

d) Draw the symbol of Demultiplexer and describe working of 1 : 4 demultiplexer.

Ans: **Symbol of 1 : 4 de-multiplexer:** **(2 Marks)**



I	Select S0	Select S1	O/P D0	O/P D1	O/P D2	O/P D3
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	1	0
1	1	1	0	0	0	1

or equivalent dia.

de-multiplexer working: **(2 Marks)**

It accepts single input and distributes it over several outputs. The single input should appear over which output line is decided by select lines.

e) Draw a neat sketch of stroboscope and explain it's working principle.

Ans: **Diagram of stroboscope :** **(Figure : 2 Mark & Explanation: 2 Marks)**

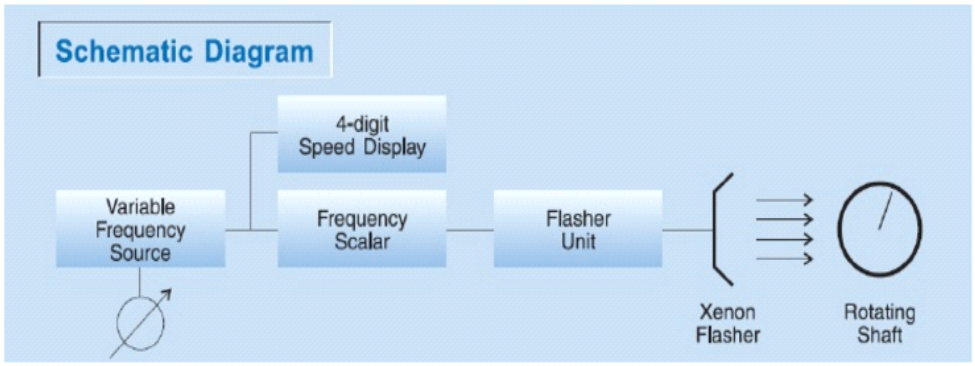


Fig. Schematic diagram of stroboscope

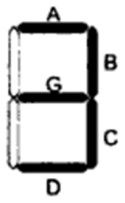
Working of stroboscope :

The principle of operation of stroboscopic instruments is as follows: the object performing periodic motion is illuminated and made visible in separate time intervals that are very small by comparison with the period of the object's motion. If the frequency fstr of the light pulses is the same as the frequency f obj of the period of the object's motion, then the object appears stationary.

When these two frequencies are somewhat different, the object appears to be executing a motion that is slower than the actual motion. The frequency F of the slowed motion is the difference between the two frequencies — that is, F = f obj – f str.

f)	**Describe the working of 7-segment LED display.**
Ans:	**Working of seven-segment LED display:-** **(Allotted 4 Marks)**

Seven segment displays consists of Eight LEDs. Depending on the various digits and letters to be displayed, the combinations of LEDs are forward biased.

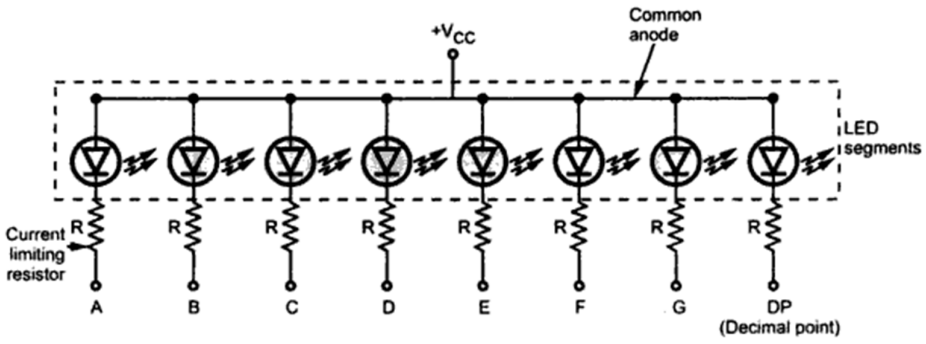


e.g. suppose we want to display the digit 3, then LED a,b,g.c,d should only be forward biased.

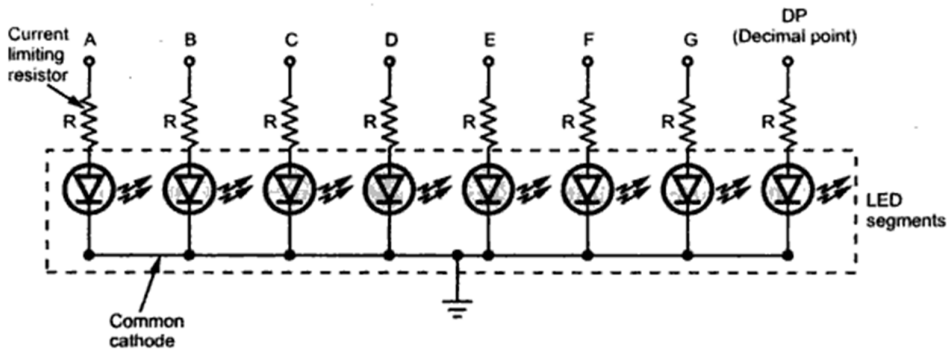
The two types of seven segment display are available-

1. Common anode type
2. Common cathode type

In common anode type, all anodes of LEDs are connected together and common point is connected to +Vcc.



In common cathode type, all cathodes of LEDs are connected together and the common point is connected to the ground.


Current limiting resistor
A
B
C
D
E
F
G
DP (Decimal point)
R
LED segments
Common cathode

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