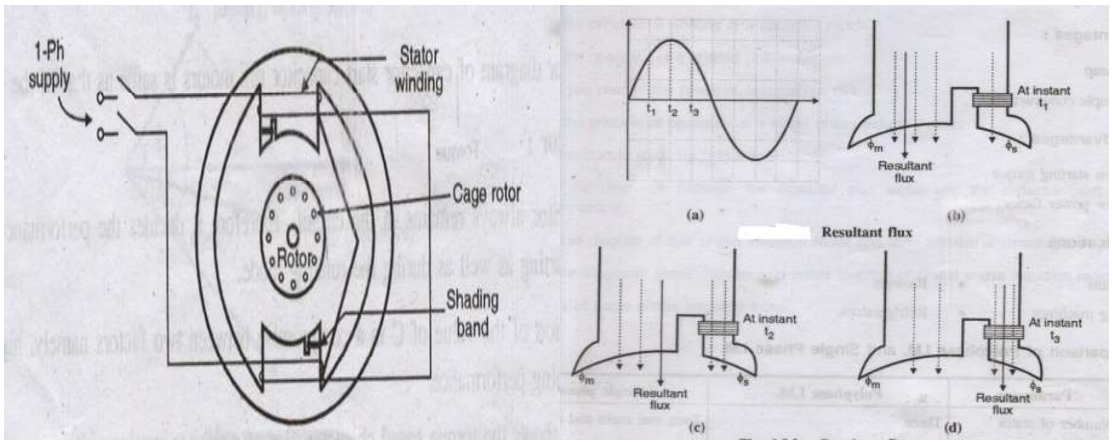
Important suggestions to examiners:

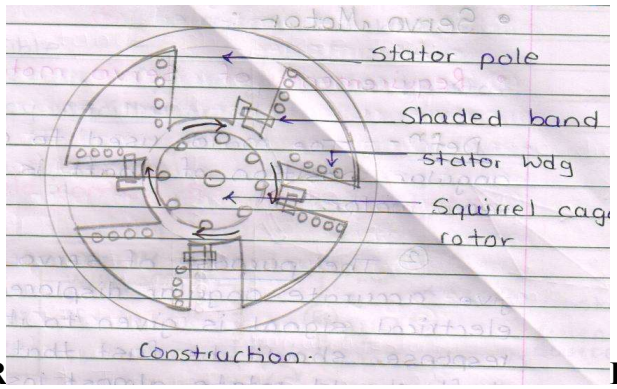
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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 Three of the following :** **12 Marks**
a)	**Define following terms. i) Magnetic flux ii) Flux density iii) Field intensity iv) Reluctance**
Ans	**i) Magnetic flux (ϕ) :-** **(1 Mark)** The total number of lines of force comprising the magnetic field is called magnetic flux or Group of lines of force is known as magnetic flux $\varphi = Its\ unit\ is Wb$ **ii) Magnetic flux density:-** **(1 Mark)** Magnetic flux is passing perpendicularly per unit area is called magnetic flux density. $B = \varphi / A\ Wb/m^2$ $B = Magnetic\ density$ $\varphi = flux$ $a = Area$ **iii) Field intensity:** **(1 Mark)** If the magnetic circuit is homogeneous and of uniform cross sectional area, the magneto motive force (M.M.F) per unit length is called magnetic field intensity. $Magnetic\ field\ intensity\ (H) = \frac{M.M.F}{Length}$ **iv) Reluctance (s) :-** **(1 Marks)** Reluctance is the property of the material which opposes the creation of flux.

b)	**Explain working of 'shaded pole motor', with a neat schematic diagram.**
Ans	**i) Shaded Pole Induction Motor :** **(Figure-2 Mark & Explanation: 2 Mark)**



or



OR **Equivalent Fig.**

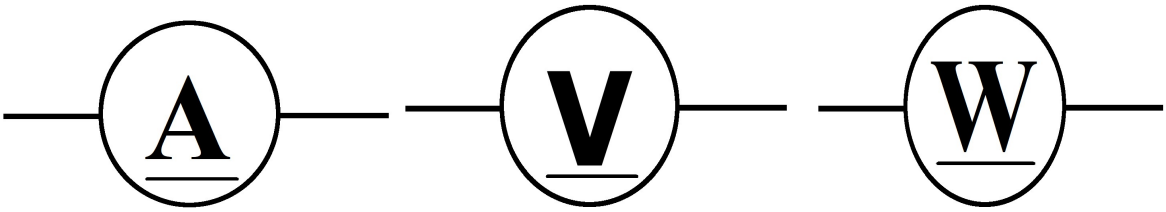
Working:-

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.

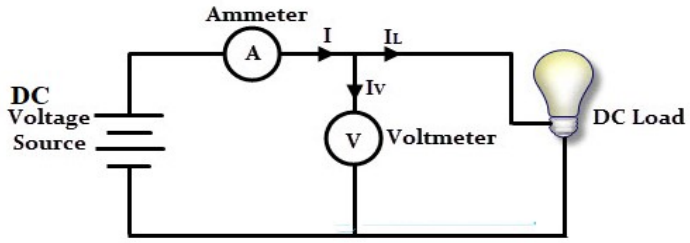
Now consider three different instants of time t_1, t_2, t_3 of the flux wave to examine the effect of shading coil as shown in the fig above. The magnetic neutral axis shifts from left to right in every half cycle, from non shaded area of pole to the shaded area of the pole. This gives to some extent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

c)	**State the importance of colour coding in automobile electrical 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)	**What is Intrinsic and Extrinsic semiconductor ?**
Ans	**a) Intrinsic semiconductor-** **(2 Mark)** The semiconductor which is in purest form like Si, Ge (without impurities/ doping) is called "Intrinsic semiconductor." **b) Extrinsic semiconductor-** **(2 Mark)** The semiconductor with doping of trivalent materials (Boron , Aluminium) or pentavalent materials (Phosphorus , Arsenic) is called "Extrinsic semiconductor." OR When the impurities are added to the intrinsic semiconductor, it becomes an extrinsic semiconductor
Q.1 B)	**Attempt any ONE of the following :** **06 Marks**
a)	**Draw symbols of D.C. ammeter, voltmeter, wattmeter. What is the procedure of connecting an ammeter and voltmeter in a D.C. ? Give connection diagram.**
Ans	**Symbols of D.C. ammeter, voltmeter, wattmeter.** **(2 Marks)**  **The procedure of connecting an ammeter and voltmeter in a D.C:** **(2 Marks)** **DC ammeter:-** Connect in series with the load whose current is to be measure **DC voltmeter:-** Connect in parallel with the load whose voltage is to be measure

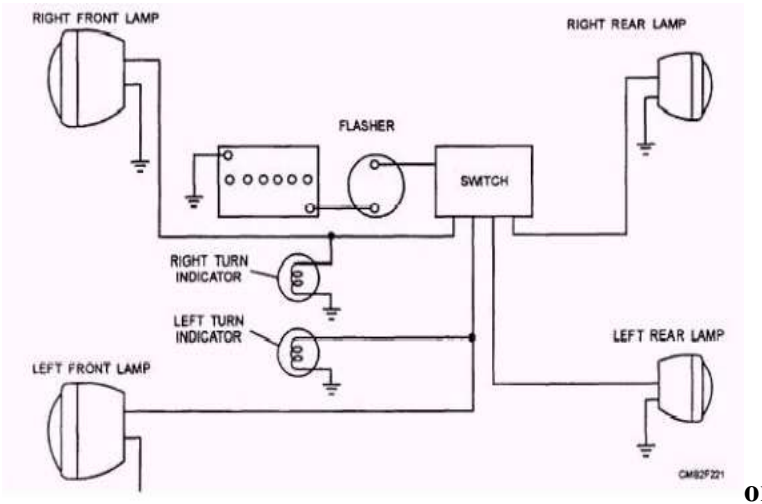
➢ **Connection diagram** **(2 Marks)**



or equivalent diagram

b) Draw wiring diagram for turn indicator. Describe it.

Ans **Turn indicator:** **(Diagram 3 Mark& Explanation: 3 Marks)**

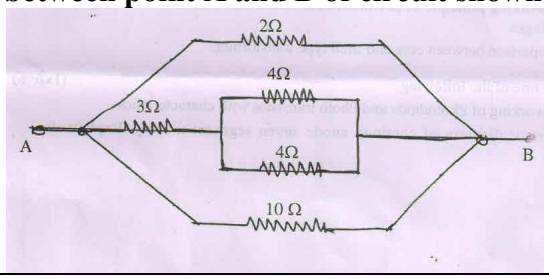


or equivalent dia.

Explanation:

The turn indicator is a gyroscopic instrument that works on the principle of precession. The gyro is mounted in a gimbal. The gyro's rotational axis is in-line with the lateral (pitch) axis of the aircraft, while the gimbal has limited freedom around the longitudinal (roll) axis of the aircraft. **OR**

It is a device consisting of a wheel or disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction. The orientation of the axis is not affected by tilting of the mounting, so gyroscopes can be used to provide stability or maintain a reference direction in navigation systems, automatic pilots, and stabilizers

Q.2	**Attempt any FOUR of the following :**	**16 Marks**
a)	**Find the total resistance between point A and B of circuit shown below.** 	
Ans:	**Solution:**	

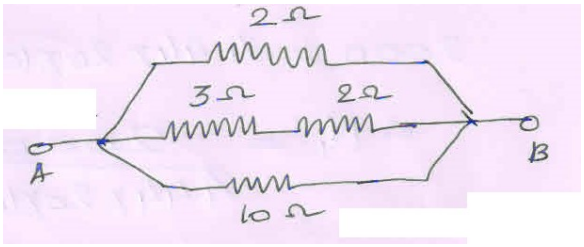
i) Equivalent Resistance 4 Ω& 4Ω in parallel :

$$R_{T1} = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$R_{T1} = \frac{4 \times 4}{4+4} = \frac{16}{8}$$

$$R_{T1} = 2\ \Omega$$

---------- **(1 Mark)**

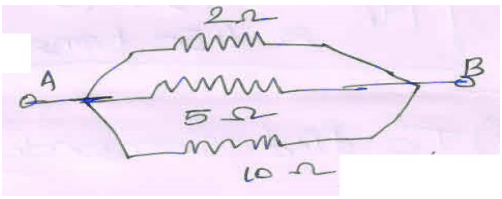


ii) Equivalent Resistance 3 Ω& 2Ω in series : **(1 Mark)**

$$R_{T2} = R_1 + R_2$$

$$R_{T2} = 3 + 2$$

$$R_{T2} = 5 \text{ ohm}$$



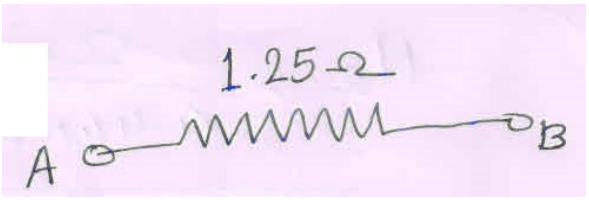
iii) Equivalent Resistance 2 Ω, 5 Ω & 10 Ω in parallel :

$$\frac{1}{R_{eq}} = \frac{1}{R_{T1}} + \frac{1}{R_{T2}} + \frac{1}{R_{T3}}$$

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{5} + \frac{1}{10}$$

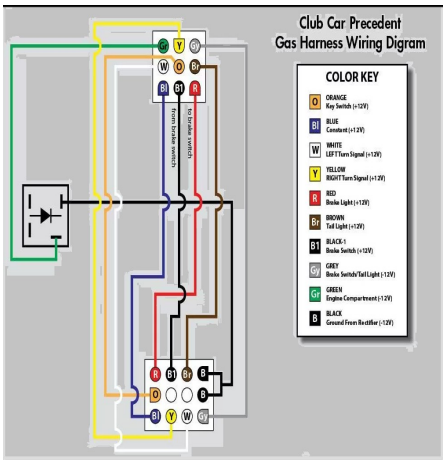
$R_{eq} = 1.25\ \Omega$

---------- **(2 Mark)**



b) Write a note on 'Wiring Harness'.

Ans: **Wiring harness:** **(Figure: 1 Mark & Explanation: 3 Mark)**

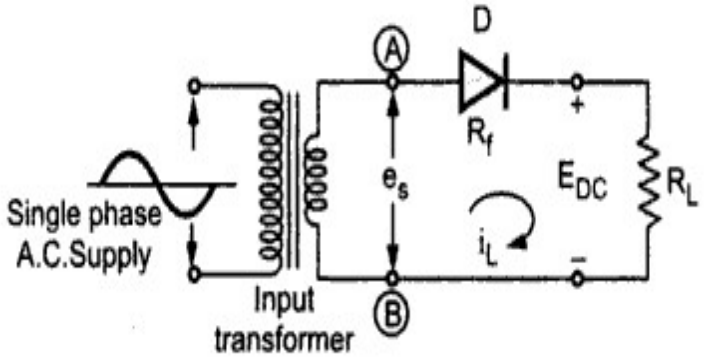
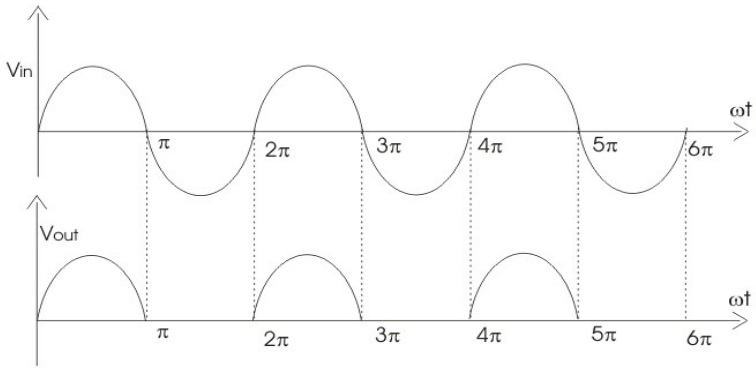


or equivalent figure

Wiring harness:

A cable harness, also known as a wire harness, cable assembly, wiring assembly or wiring loom, is an assembly of cables or wires which transmit signals or electrical power. The cables are bound together by straps, cable ties, cable lacing, sleeves, electrical tape, conduit, a weave of extruded string, or a combination thereof

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.

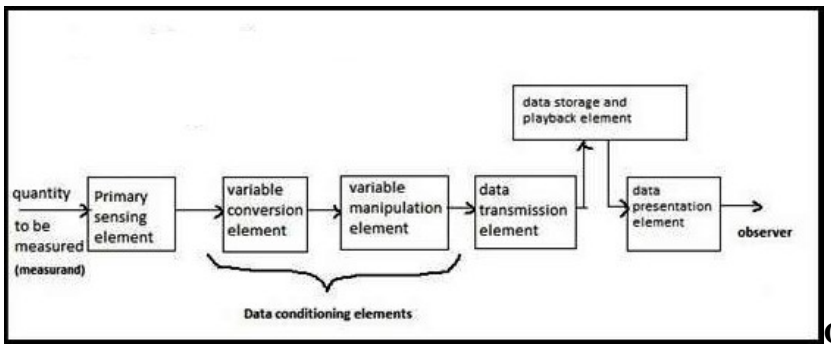
c)	**Explain, why 1-ph induction motor are not self starting.**
Ans:	Reason: **(4 Marks)** The single phase induction motors are not self - starting because single phase supply is alternating but not produces rotating magnetic field which is the necessity for self- starting of single phase I.M. Torque obtain by single phase supply is pulsating i.e. at positive half cycle rotor rotates in clockwise direction and at negative half cycle rotor rotates in anticlockwise direction so net torque is zero and due to inertia of rotor remains standstill.
d)	**Explain operation of 'Half Wave Rectifier' with circuit diagram.**
Ans:	**Half wave rectifier Circuit diagram::** **(1 Mark)**  or equivalent figure **Waveforms** : **(1 Mark)**  **Working :** **(2 Mark)** During positive half cycle of an AC supply, Diode D will forward biased and current starts flowing through load. The output voltage is equal to +Vs. During negative half cycle of an AC supply, Diode D will reverse biased and source is

disconnected from load. Therefore output voltage is equal to 0V.

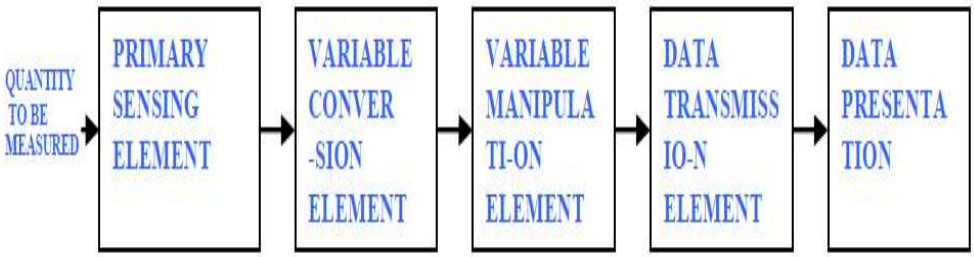
In this pulsating DC waveform will be obtained at the load.

e) Draw block diagram and explain in brief 'General Measurement System'.

Ans: **Block Diagram of General measurement system:-** **(2 Mark)**



OR



OR Equivalent Fig

Explanation of general measurement system:- **(2 Mark)**

A generalized measurement system consists of the following components:

1. Primary Sensing Element
2. Variable Conversion Element
3. Variable Manipulation Element
4. Data Processing Element
5. Data Transmission System
6. Data Presentation Element

In addition to the above components, a measurement system may also have a data storage element to store measured data for future use. As the above six components are the most

common ones used in many measurement systems, they are discussed in detail below:

1. Primary Sensing Element:

The primary sensing element receives signal of the physical quantity to be measured as input. It converts the signal to a suitable form (electrical, mechanical or other form), so that it becomes easier for other elements of the measurement system, to either convert or manipulate it.

2. Variable Conversion Element:

Variable conversion element converts the output of the primary sensing element to a more suitable form. It is used only if necessary.

3. Variable Manipulation Element:

Variable manipulation element manipulates and amplifies the output of the variable conversion element. It also removes noise (if present) in the signal.

4. Data Processing Element:

Data processing element is an important element used in many measurement systems. It processes the data signal received from the variable manipulation element and produces suitable output.

Data processing element may also be used to compare the measured value with a standard value to produce required output.

5. Data Transmission System:

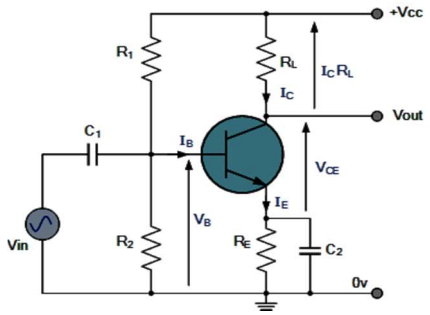
Data Transmission System is simply used for transmitting data from one element to another. It acts as a communication link between different elements of the measurement system. Some of the data transmission elements used are cables, wireless antennae, transducers, telemetry systems etc.

6. Data Presentation Element:

It is used to present the measured physical quantity in a human readable form to the observer. It receives processed signal from data processing element and presents the data in a human readable form. LED displays are most commonly used as data presentation elements in many measurement systems.

f) How transistor works 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 $=\beta I_B$ 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.

Q.3	Attempt any FOUR of the following : 16 Marks
a)	**Define : i) Accuracy ii) Precision iii) Resolution iv) 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) Resolution:** **(1 Mark)** The smallest change in the input quantity that will be measured by the meter. **(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.
b)	**State the working principle of D.C. motor. Draw symbols of PN junction and Zener diode.**
Ans:	**Working Principle of D.C Motor :-** **(2 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.

Symbols of PN junction and Zener diode: **(2 Marks)**

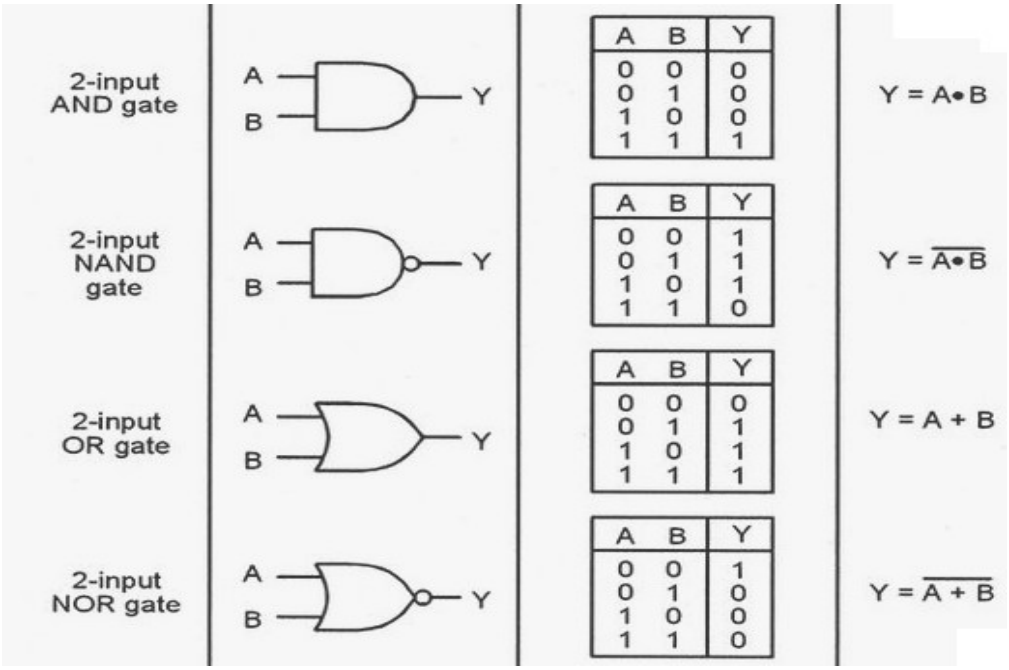
Symbol of PN Junction:

Symbol of Zener Diode:

c) **Draw symbol and write Boolean's equations of following logic gates. i) AND ii) OR iii) NAND iv) NOR Give T.T. also.**

Ans: **Symbol and write Boolean's equations of following logic gates :**

(Each Logic gate : 1 Mark, Total 4 Marks)



d) **Define peak factor and form factor. State their values for a sinusoidal quantity.**

Ans: **i) Peak factor-** **(2 Mark)**

It is defined as the ratio of the maximum value to its RMS Value

$$PeakFactor = \frac{\text{Maximum value}}{\text{RMS value}}$$

- **The value of Peak Factor is :** 1.4142

ii) Form factor- **(2 Mark)**

It is defined as the ratio of its RMS value to its Average value.

- **The value of Form Factor is:** 1.11

e) Compare electrical and mechanical instruments.

Ans: **(Any four point expected- 1 Mark each point)**

S.No.	Electrical Instrument	Mechanical Instruments
1	These instruments are used for rapid changes. Or sensitivity of the electrical instrument is more	These instruments are used for static & stable condition. Or sensitivity of the electrical instrument is less
2	They are able to record dynamic & transient condition.	They are unable to respond rapidly to measurement of dynamic & transient condition.
3	Instruments are consists of moving parts that are light in weight.	Instruments are consists of moving parts that are rigid, heavy & bulky.
4	Weight is less.	Weight is more.
5	It doesn't produce noise during measurement.	It produce noise & causes air pollution.
6	Rapidly indicates output.	Slowly indicates output.
7	Life of the electrical instrument is less	Life of the mechanical instrument is more

Q.4 A) Attempt any Three of the following : **12 Marks**

a) For 1-ph AC circuit, define 1) Active power 2) Reactive power. Give their units.

Ans: **i) Active Power (P):-** **(2 Mark)**

The active power is defined as the average power P_{avg} taken by or consumed by the given circuit.

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

ii) Reactive Power (Q):- **(2 Mark)**

The reactive power is defined as the product of voltage and current (V, I) and sine of angle between voltage (V) and current (I) i.e. ϕ

OR

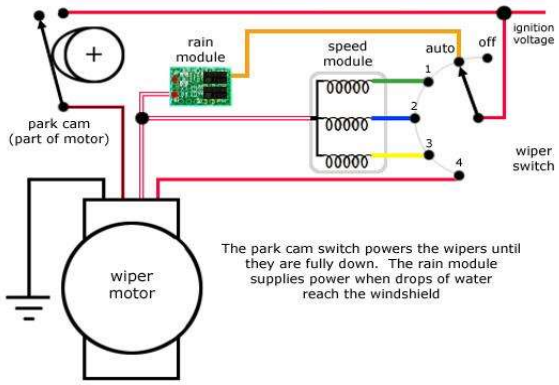
The power which flows back and froth that mean it moves in both the direction in the circuit or react upon itself, is called Reactive Power. The reactive power is measured in volt ampere reactive (kVAR).

$Q = V.I. \sin \phi$

Units: - VAR **OR** KVAR

b) Draw the wiring diagram for Windshield Wiper. Describe it.

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



or any equivalent

Explanation:- **(2 Marks)**

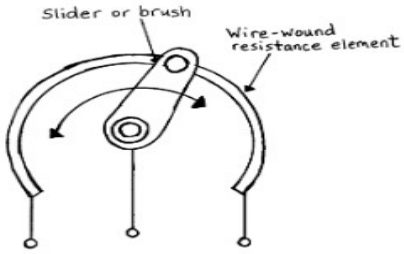
The ignition switch supplies electrical power for the wiper motor. Current passes through the wiper control switch and then to the wiper motor. A speed control module may vary the voltage that reaches the motor on some models. Other types use different windings in the motor to control speed.

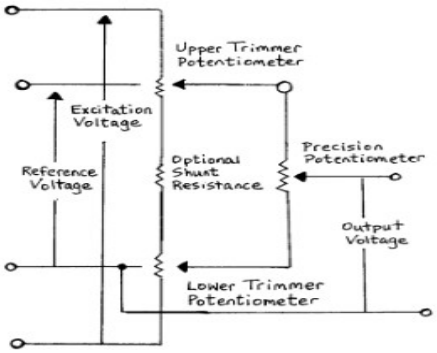
Within the wiper-motor is another switch, with voltage that bypasses the off-switch. The motor times this device with the full down position. Many use a cam to open the circuit when the motor achieves wiper parking. Turn off the wiper switch and current continues to flow through the park-switch, until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

c)	**What is working principle of potentiometric transducer? Give its advantages and disadvantages.**

Ans:

Potentiometric transducer **(1 Mark)**





Working **(2 Marks)**

Potentiometers are variable resistance devices. A change in the linear or angular displacement of a potentiometer varies the effective length of its conductor, and therefore the resistance of the device. This change in resistance can be related to the displacement through a change in output voltage. Potentiometers have a tendency for nonlinearity, and care must be taken when a high degree of accuracy is required. Trimmer potentiometers are often built into the circuit to adjust the maximum and minimum output voltage to correspond to the maximum and minimum displacements of the measurement potentiometer

Advantages : **(Any one advantage expected :1/2 Mark)**

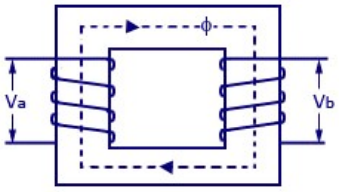
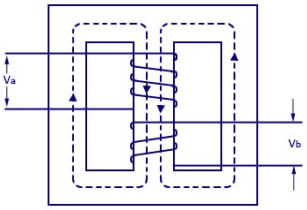
1. They are cheap.
2. Efficiency is high.
3. Resolution is infinite.

Disadvantages: **(Any one disadvantage expected :1/2 Mark)**

1. Large force is required to move sliding contacts. i.e. wiper.
2. There is limited bandwidth.

d) Give comparison between core and shell type transformer.

Ans: **(Any Four points expected each point 1 Mark)**

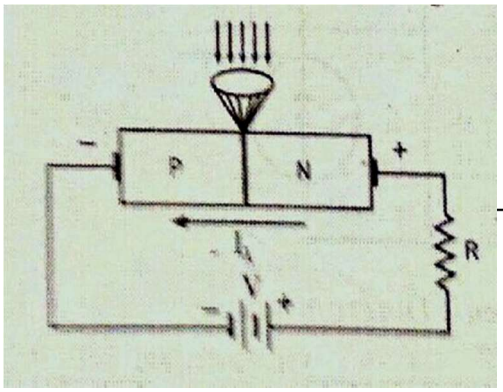
S.No	Core Type Transformer	Shell Type Transformer
1.		
2.	The Winding surround the core	The core surround the windings
3.	Magnetic Flux has only one continuous path	Magnetic Flux is distributed into 2 paths
4.	Suitable for high voltage & less output	Suitable for less voltage & high output
5.	Easy for repairs	Difficult for repairs
6.	Less in Weight	More in Weight
7.	Leakage flux are more	Leakage flux are less

Q.4 B) Attempt any ONE of the following : 06 Marks

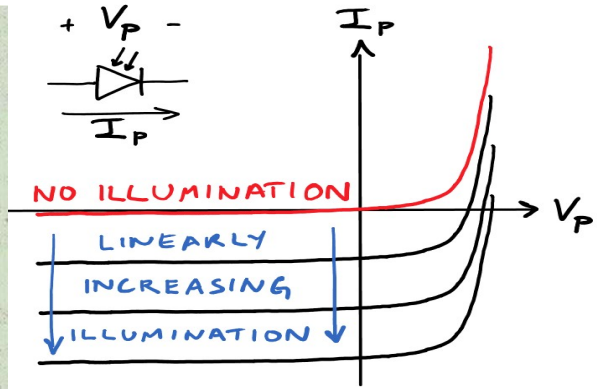
a) Explain working of Photodiode and Photo transistor with characteristics.

Ans: **i) Photodiode : (Figure : 1 Mark & Explanation: 1 Mark, Characteristics: 1 Mark)**

Schematic diagram:



Characteristics:



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

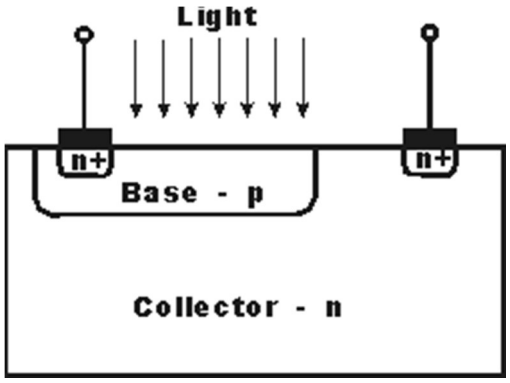
sufficient energy strikes the diode, it excites an electron, thereby creating a free electron (and a positively charged electron hole).

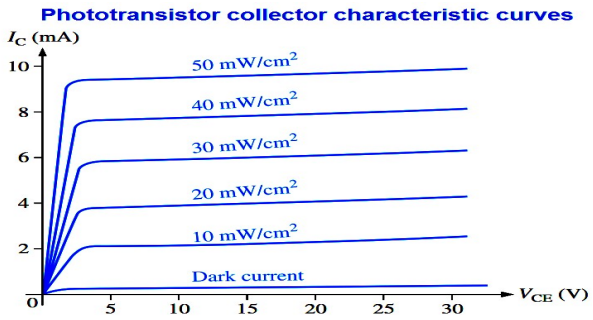
When a reverse biased P-N junction is illuminated, the current flowing through it varies almost linearly with light flux. The output voltage is taken from across a series-connected load resistor R as shown in above figure.

(Figure : 1 Mark & Explanation: 1 Mark, Characteristics: 1 Mark)

ii) Photo transistor :

Construction : **Characteristics:**





OR Equivalent Figure

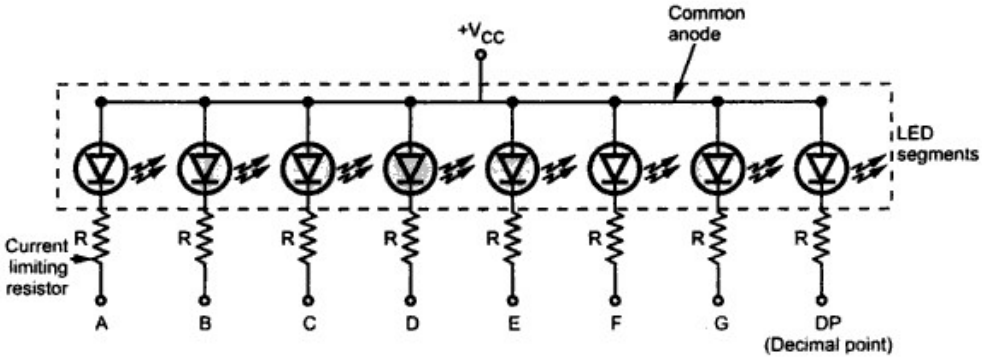
Working :

A phototransistor is similar to a regular BJT except that the base current is produced and controlled by light instead of a voltage source. The phototransistor effectively converts light energy to an electrical signal.

In a phototransistor the base current is produced when light strikes the photosensitive semiconductor base region. The collector-base pn junction is exposed to incident light through a lens opening in the transistor package. When there is no incident light, there is only a small thermally generated collector-to-emitter leakage current, ICEO; this dark current is typically in the nA range. When light strikes the collector-base pn junction, a base current, Iλ, is produced that is directly proportional to the light intensity. This action produces a collector current that increases with Iλ. Except for the way base current is generated, the phototransistor behaves as a conventional BJT. In many cases, there is no electrical connection to the base.

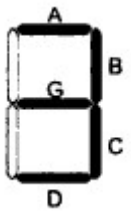
b)	**Draw circuit diagram of common anode seven segment display. Explain its working.**
Ans:	**Working of common anode seven-segment LED display:-**

Circuit Diagram : **(3 Marks)**



Working : **(3 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.

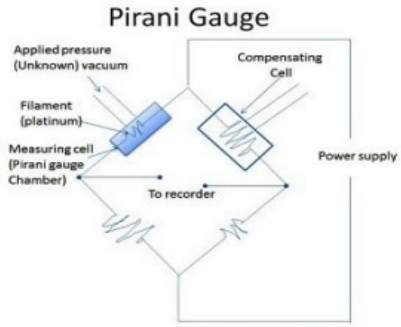
In common anode type, all anodes of LEDs are connected together and common point is connected to +Vcc.

A 7 segment display is made of seven different illuminating segments. These are arranged in a way to form numbers and characters by displaying different combinations of segments. The binary information is displayed using these seven segments. LED or light emitting diode is P-N junction diode which emits the energy in the form of light.

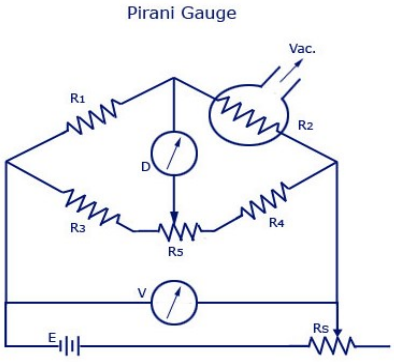
Q.5	Attempt any FOUR of the following : 16 Marks
a)	**Explain with diagram `Pirani Vaccum Gauge'.**
Ans:	**Principle of pirani vacuum gauge :** **(Principal: 2 Marks & Diagram: 2 Marks)**

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



or equivalent figure

b)	**What is a stepper motor ? State its types.**
Ans:	**Stepper Motor:** **(2 Marks)**

- Stepper motors are DC motors that move in discrete steps. **OR**
- A stepper motor is an electromechanical device it converts electrical power into mechanical power. Also it is a brushless, synchronous electric motor that can divide a full rotation into an expansive number of steps.

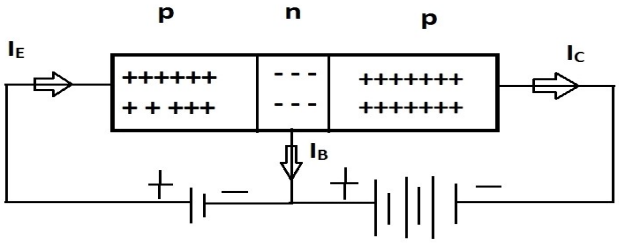
Types of Stepper Motor :- **(2 Marks)**

1) Variable Reluctance Motor
2) Permanent Magnet Motor
3) Hybrid stepper motor

c)	**Explain with diagram, working of `PNP' transistor.**

Ans:

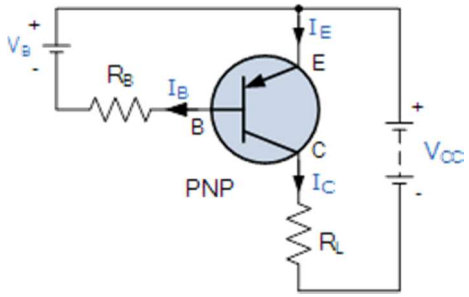
Diagram : **(Diagram- 1 Mark & Working -3 Marks)**



p-n-p transistor

Working :

The **PNP Transistor** has very similar characteristics to their NPN bipolar cousins, except that the polarities (or biasing) of the current and voltage directions are reversed for any one of the possible three configurations.



PNP Transistor Connection

The voltage between the Base and Emitter (V_{BE}), is now negative at the Base and positive at the Emitter because for a PNP transistor, the Base terminal is always biased negative with respect to the Emitter.

Also the Emitter supply voltage is positive with respect to the Collector (V_{CE}). So for a PNP transistor to conduct the Emitter is always more positive with respect to both the Base and the Collector.

The voltage sources are connected to a PNP transistor are as shown. This time the Emitter is connected to the supply voltage V_{CC} with the load resistor, RL which limits the maximum current flowing through the device connected to the Collector terminal. The Base voltage V_B which is biased negative with respect to the Emitter and is connected to the Base resistor R_B, which again is used to limit the maximum Base current.

To cause the Base current to flow in a PNP transistor the Base needs to be more negative than the Emitter (current must leave the base) by approx 0.7 volts for a silicon device or 0.3 volts for a germanium device with the formulas used to calculate the Base resistor, Base current or Collector current are the same as those used for an equivalent NPN transistor and is given as.

$$I_C = I_E - I_B$$

$$I_C = \beta . I_B \qquad I_B = \frac{I_C}{\beta}$$

d)	**Describe positive and negative return system in a automobile electrical system.**

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

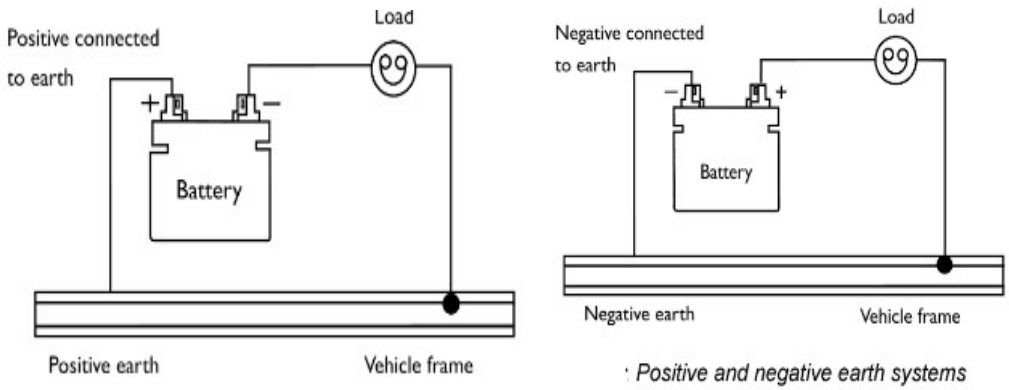
Negative return system: ---------- **(2 Marks)**

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) A 2000/200 V, 1-ph, 50 Hz transformer has the maximum flux of 20 mwb. Find out the number of turns on the primary and secondary windings, if the cross sectional area of core is 1.1 cm2

Ans: $V_1 = 2000V$, $V_2 = 200V$, F= 50 Hz $\phi_m = 20$ mwb $= 20 \times 10^{-3}$ wb A = 1.1 cm^2

1. To Find Primary No. of Turns:

$V_1 = 4.44\,\phi_m\, f\, N_1$ ..... **(1 Marks)**

$2000 = 4.44 \times 20 \times 10^{-3} \times 50 \times N_1$

$N_1 = \dfrac{2000}{4.44 \times 50 \times 20 \times 10^{-3}}$,

$N_1 = 450.45 \cong 450\ turns$ ..... **(1 Marks)**

1. To Find Secondary No. of Turns:

$V_2 = 4.44\,\phi_m\, f\, N_2$ ..... **(1 Marks)**

$200 = 4.44 \times 20 \times 10^{-3} \times 50 \times N_2$

$N_2 = \dfrac{200}{4.44 \times 50 \times 20 \times 10^{-3}}$,

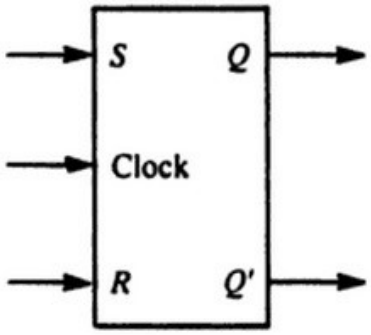
$N_2 = 45.04 \cong 45\ turns$ ..... **(1 Marks)**

f) What is a Flip Flop ? Draw symbol of R.S. Flip Flop.

Ans: **Flip-Flop :** **(2 Marks)**

Flip-flops, also called bistable gates, are digital logic circuits that can be in one of two states. Flip-flops maintain their state indefinitely until an input pulse called a trigger is received

Symbol of RS Flip flop: **(2 Marks)**

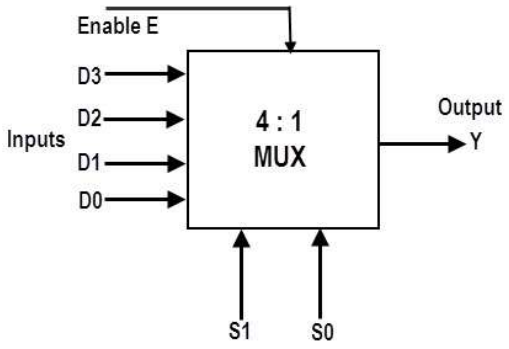


or equivalent fig

Q.6	**Attempt any FOUR of the following :**	**16 Marks**
a)	**Draw symbol of 4 : 1 multiplexer. Give T.T. also.**	

Ans:

Symbol of 4 : 1 Multiplexer: **(2 Mark)**



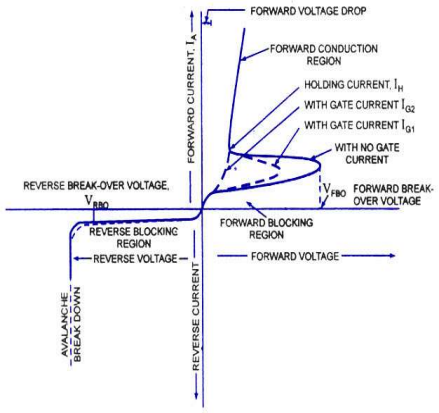
or equivalent dia.

Truth Table of 4 : 1 Multiplexer: **(2 Mark)**

Select Data Inputs		Output
S_1	S_0	Y
0	0	D_0
0	1	D_1
1	0	D_2
1	1	D_3

b)	**Draw V.I. characteristics of S.C.R. Describe it.**

Ans: **VI characteristics of SCR:** **(V.I. Characteristics : 2 Marks, Description : 2 Marks)**



V-I Characteristics of SCR

or equivalent figure

Working-

When the anode is made +ve w.r.t. cathode, the junctions J1 and J3 are forward biased, whereas junction J2 is reverse biased. Due to this reverse biased junction J2, only small

leakage current flows from anode to cathode. The S.C.R. is then said to be in forward blocking state.

With anode +ve w.r.t. cathode, if anode-to-cathode voltage is increased to a sufficient large value, the reverse biased junction J2 will break. The voltage at which it occurs is called forward break over voltage V_{BO}. The junctions J1 and J3 are already forward biased, hence results in free movement of carriers across all three junctions, resulting in large forward anode current. The S.C.R. is said to be in conducting state.

Without breakdown of junction J2, S.C.R. can be made ON by applying +ve voltage to gate w.r.t. cathode. Due to this, junction J3 is forward biased and conducts and gate current flows. Free movement of carriers (holes and electrons) across the junction J3 results in injection of holes into n-region and electrons into p-region. The injected electrons in p-region force this p-region to lose its identity as p-region because it was having holes as majority carriers but with injected electrons, it is having holes as well as electrons in majority. Therefore junction J2 now has majority electrons on both side and it is disappeared and S.C.R. is made ON.

c) Draw a neat sketch of stroboscope. Explain its working.

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

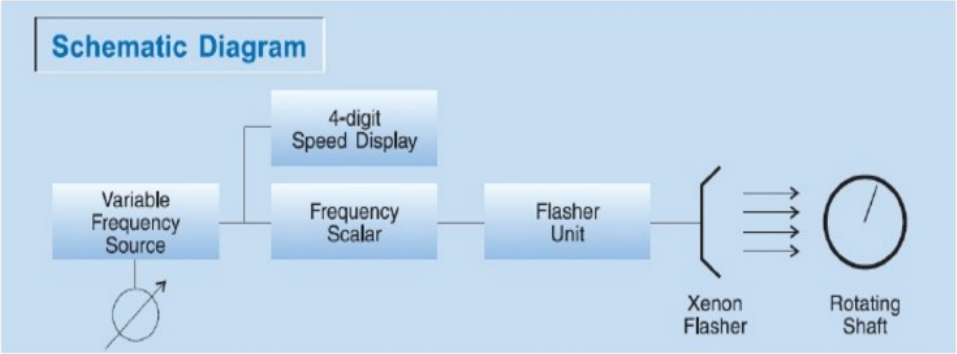


Fig. Schematic diagram of stroboscope

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.

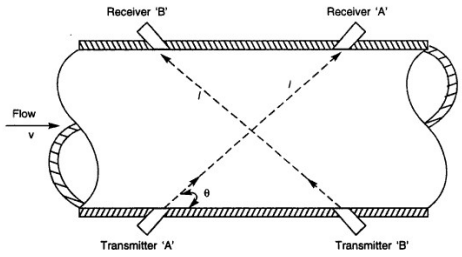
When these two frequencies are somewhat different, the object appears to be executing a motion that is slower than the actual motion. The frequency F of the slowed motion is the difference between the two frequencies — that is, F = f obj – f str.

d) With a neat diagram, explain 'Ultrasonic flow meter'.

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

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

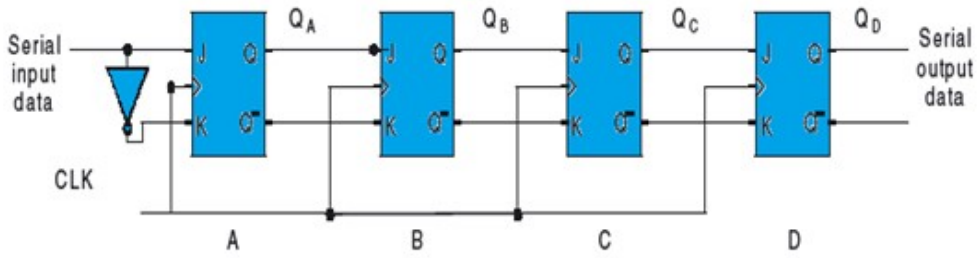
By measuring the difference in the repetition frequency Δf and knowing the values of θ and l, the velocity of the fluid can be computed alternatively, the flow velocity can be computed by measuring the transit time difference between the two pulse trains in either direction.

e)	**Explain briefly working of STSO shift register.**
Ans:	**SISO shift register :** **(Diagram: 2 Mark & Explanation: 2 Marks)**

From the name Serial in Serial out Shift Register (SISO), it is obvious that this type of register accepts data serially, one bit at a time at the single input line, and shifted to next flip flop serially. The output is also obtained on a single output line in a same serial fashion. Now depending upon the data shift within the register, it may be shifted from left to right using *shift-lef t*register, or may be shifted from right to left using *shift-right* register.

Shift-right Register

Shift right register can be constructed with either J-K or D flip flops as shown in bellow.



Shift-right register using J-K flip-flops.

Or Equivalent Figure

As we can see in above figure that J-K flip flop based shift register requires connection of both J and K inputs. Input data are connected to the J and K inputs of the left most (lowest order) flip flop of flip flop chain. And all flip flops are connected in serially. As we know that for a JK flip flop output is followed whatever the input of J and the both the input are complimentary. Let take an example to input a 0, one should apply a 0 at the J input, *i.e.*, J = 0 and K = 1 and vice versa. With the application of a clock pulse the data will be shifted by one bit to the right. In this way the first data will store at Flip flop A then in next clock pulse the date of A flip flop is shifted to filp flop B in that way finally we get the serial output from flip flop JK FF.

For example, consider that all the stages are reset and a logical input 1011 is applied at the serial input line connected to stage A. and see the bellow table that how the data shifted from one flip flop to other and finally get the output from JK FF flip flop.

Operation of the Shift-right Register

Timing pulse	Q_A	Q_B	Q_C	Q_D	*Serial output at* Q_D
Initial value	0	0	0	0	0
After 1st clock pulse	1	0	0	0	0
After 2nd clock pulse	1	1	0	0	0
After 3rd clock pulse	0	1	1	0	0
After 4th clock pulse	1	0	1	1	1

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