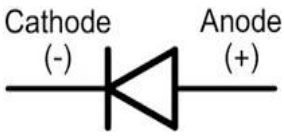
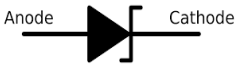
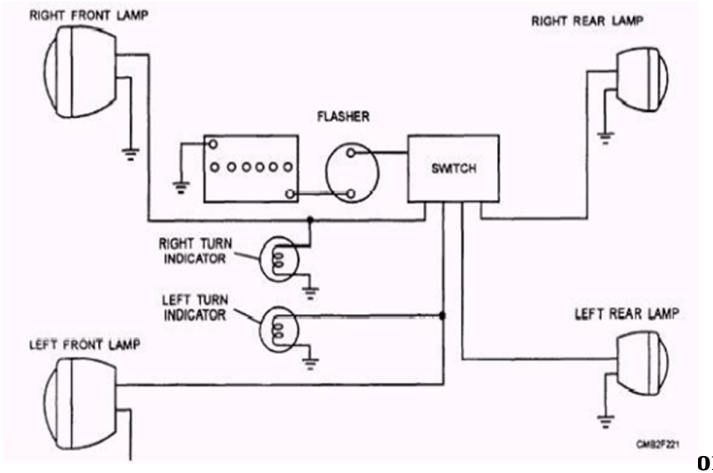
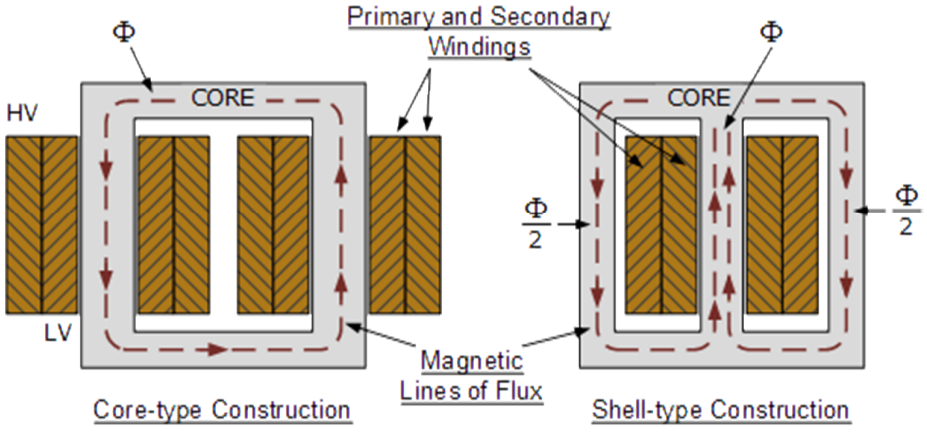
Important suggestions to examiners:

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)	**State the various types of D.C. Motor. Give at least two applications of D.C. Motor.**
Ans	**Types of DC Motor :-** **(2 Mark)** i) DC Shunt Motor ii) DC Series Motor iii) DC Compound Motor: a) Short Shunt compound motor b) Long short compound motor **Or** a) Cumulative compound DC motor b) Differential compound DC motor **Application of D.C Motor:- ------** **(Any two applications expected each:2Marks)** i) DC Shunt Motor : Lathes machine, constant head centrifugal pumps, compressor ii) DC Series Motor : For electric traction and cranes, passenger elevators, continuous conveyors, grinders, polishers, iii) DC Compound Motor: Wood working machine, Laundry washing machines, milling machines, passenger elevators, continuous conveyors, grinders, polishers, small cranes etc. Reciprocating pumps, Wood working machines.

b)	**(i)Define intrinsic and extrinsic semiconductor.** **(ii) Draw symbol of Diode and Zener diode.**
Ans	**i) Define:** **(Two Definitions 2 Marks)** **a) Intrinsic semiconductor-** The semiconductor which is in purest form like Si, Ge (without trivalent or pentavalent impurities/ doping) is called "Intrinsic semiconductor." **b) Extrinsic semiconductor-** The semiconductor which is having doping of trivalent materials (Boron , Aluminium) or pentavalent materials (Phosphorus , Arsenic) is called "Extrinsic semiconductor." **(ii) Draw symbol** **(Two Symbols 2 Marks)** **Draw symbol of Diode:** **Symbol of Zener Diode:**  
c)	**Draw the wiring diagram of 'Turn Indictor'.**
Ans	**ii) Turn indicator:** **(Diagram 2 Mark)**  **or equivalent dia.**

d)	**Define : (i) Frequency (ii) Cycle (iii) Time period (iv) Amplitude**
Ans	**(i) Frequency :** **(1 Mark)** The total number of cycles per second. **ii) Cycle:** **(1 Mark)** A complete set of variation of an alternating quantity which is repeated at regular interval of time is called as a cycle. **OR** Each repetition of an alternating quantity recurring at equal intervals is known as a cycle. **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) Amplitude:** **(1 Mark)** The maximum value of attained by alternating quantity is called amplitude
Q.1 B)	**Attempt any one of the following:** **06 Marks**
a)	**Describe construction and working of single phase transformer.**
Ans	**construction of single phase transformer :** **(3 Marks)**



- Construction of a transformer is dependent upon how the primary and secondary windings are wound around the central laminated steel core.
- The two most common and basic designs of transformer construction are the **Closed-core Transformer** and the **Shell-core Transformer**.
- In the “closed-core” type (core form) transformer, the primary and secondary windings

are wound outside and surround the core ring.

- In the "shell type" (shell form) transformer, the primary and secondary windings pass inside the steel magnetic circuit (core) which forms a shell around the windings as shown below.

Working Principle: - ---------- **(3 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.

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.

b) Define wiring Harness. State the importance of colour coding in automobile electrical wiring.

Ans **(Define : 3 Marks & Importance : 3 Marks)**

Wiring harness: **(3 Mark)**

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

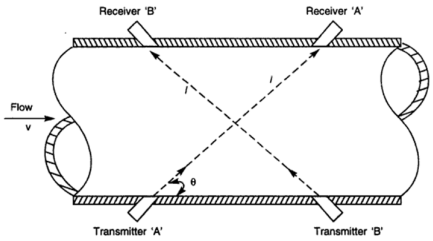
Importance of colour coding in automobile wiring: **(3 Mark)**

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.

Q.2	**Attempt any FOUR of the following: 16 Marks**
a)	**Describe working of 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.

b) State any four difference between self induction and mutual inductance.

Ans: **(Each Point : 1 Mark, Total 4 Marks)**

S.No	Self Induction	Mutual Inductance.
1	Self-Induction is the characteristic of the coil itself.	Mutual induction is the characteristic of a pair of coils placed near to each other.
2	When the main current in the coil decreases, the induced current opposes the decay of current in the coil.	When the main current in the coil decreases, induced current developed in the neighboring coil opposes the decay of current in the coil.
3	Denoted by 'L'.	Denoted by 'M'
4	$E_1 = -L \times \frac{dI}{dt}$ Volt	$E_1 = -M \times \frac{dI_1}{dt}$ or $E_2 = -M \times \frac{dI_2}{dt}$ Volt

c) Draw any four electrical symbols.

Ans: **Electrical Symbols;** **(Any four symbols are expected- 1 Mark each)**

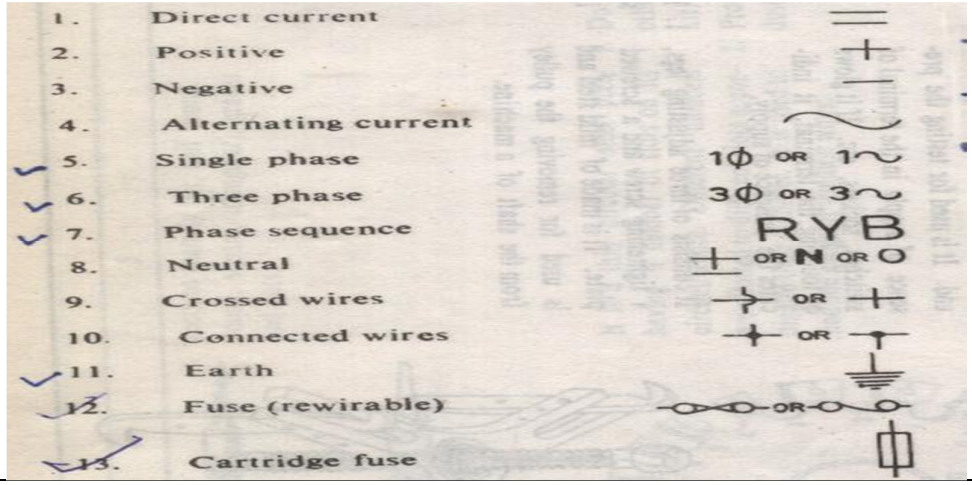
Note: Student may draw other than these symbols may be accepted

Name	Electrical Symbol	Name	Electrical Symbol
Ground		Attenuator	
Equipotentiality		Capacitor	
Chassis		Accumulator	
Battery		Antenna	
Resister		Loop antenna	
Circuit breaker		Crystal	
Fuse		Half inductor	
Ideal source		Pickup head	

Generic component		Pulse	
Transducer		Saw tooch	
Inductor		Step function	
Explosive squib		Permanent magnet	
Sensing link squib		Magnet core	
Squib igniter		Ferrite core	
Surge protectors		Igniter plug	
Material		Buzzer	
Delay element		Thermalelement	
Thermocouple		Speaker	
Lamp		Microphone	
Fluorescent lamp		Oscillator	
AC source		Thermopile	
DC source			

OR

Any four symbols from below or equivalent symbols accepted)



14. Porcelain connector single way

15. Neutral link

16. Single pole switch

17. Two-way switch

18. Push button switch

19. Intermediate switch

20. Lamp

23. Fan

24. Fan regulator

25. Two-pin wall socket

26. Three-pin wall socket

27. Two-plate ceiling rose

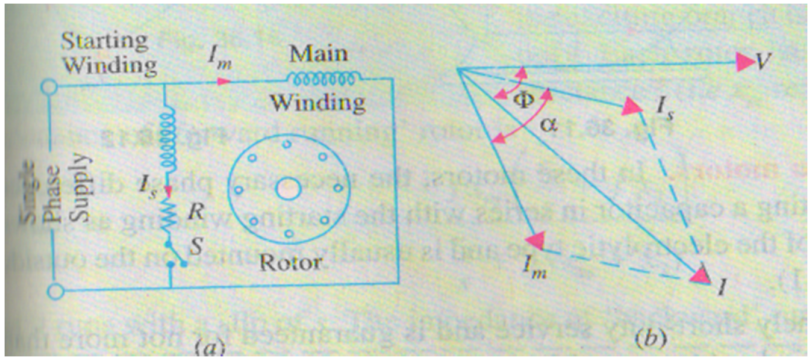
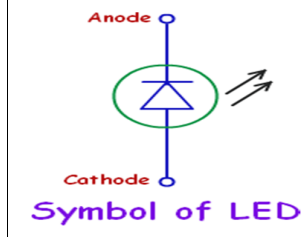
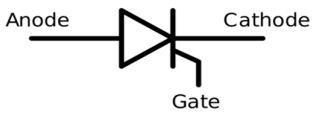
28. Three-plate ceiling rose

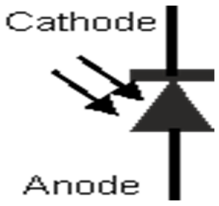
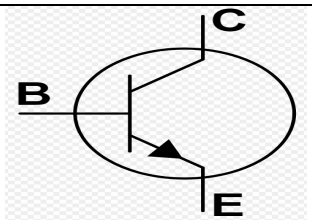
29. Electric bell

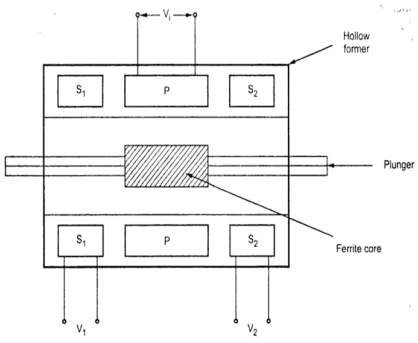
30. Electric buzzer

35. Double-pole, iron clad main switch with fuses

36. Triple-pole, iron clad main switch with fuses

d)	**Describe working of resistance split phase induction motor with help of diagram.**
Ans:	**(Diagram: 2 Mark & Working: 2 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 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.
e)	**Draw symbols of LED, SCR, photodiode and N—P—N transistor.**
Ans:	**(Each Symbol: 1 Mark)** **Symbol of LED:**  Symbol of LED **Symbol of SCR :**  **Symbol of Photodiode :** **Symbol of N-P-N :**

	 
f)	**Define the terms : (i) Dynamic error (ii) Sensitivity (iii) Accuracy (iv) Speed of response**
Ans:	**(Each Defamation: 1 Mark)** **i) Dynamic Error:** It is the difference between the true value of the quantity that is to be measured, changing with time and the measured value, if no static error is assumed. **ii) Sensitivity** 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. **iii) Accuracy** – 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. **iv) Speed of response:** It is defined as the rapidity with which an instrument, responds to the changes in the measured quantity.
Q.3	**Attempt any FOUR of the following: 16 Marks**
a)	**Draw a labelled diagram of LVDT and describe its function as gauge for displacement measurement.**
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-**



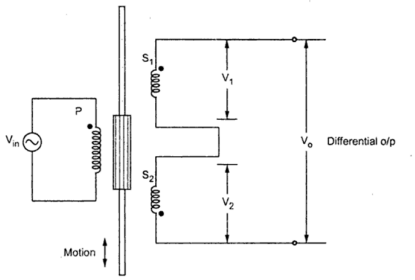
or equivalent dia.

P= primary winding

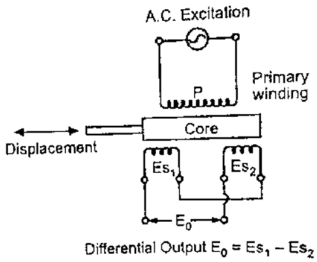
S1, S2= two secondary windings.

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.

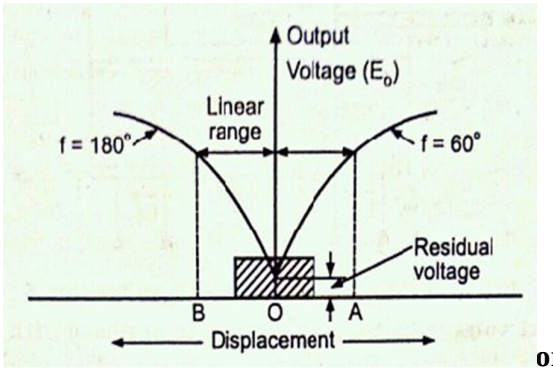
With the core in the centre, the induced voltages V1 and V2 in the secondary S1 and S2 are equal, since they oppose each other; the output will be zero volts.

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.

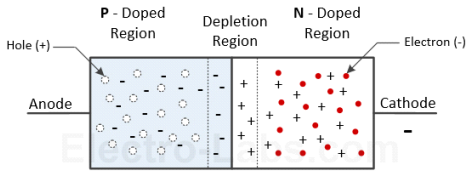


or equivalent dia.

b) Describe working of P-N junction diode. Draw characteristics also.

Ans: **(2 Mark for working , 2 Marks characteristics)**

Construction of PN junction diode: -



or equivalent figure

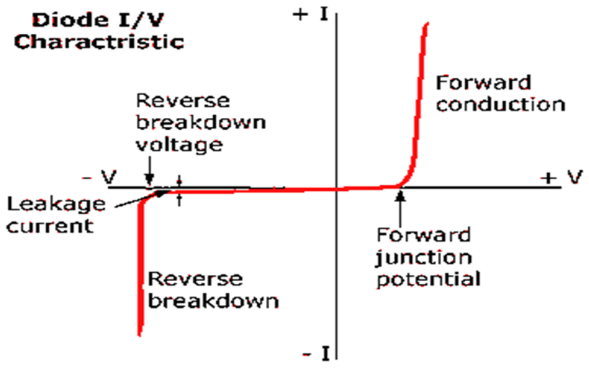
A P-N junction is formed at the boundary between a p-type and n-type semiconductor created in a single crystal of semiconductor by doping.

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:

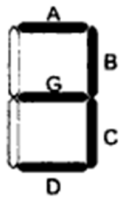


or equivalent figure

c) Describe the working of seven 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.

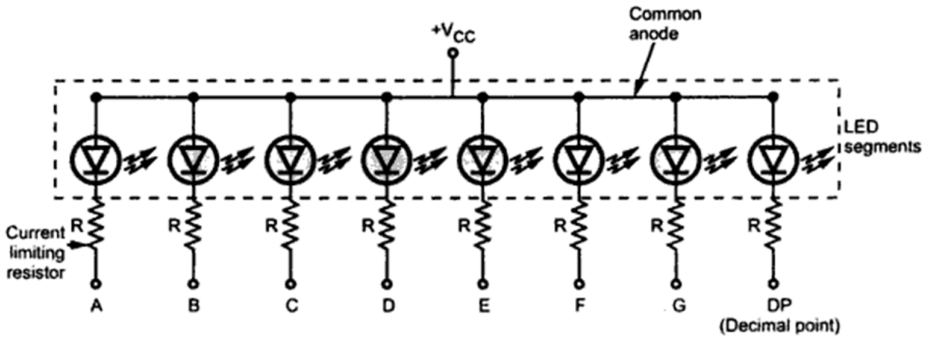


e.g. suppose we want to display the digit 3, then LED a,b,g.c,d should only be forward biased.

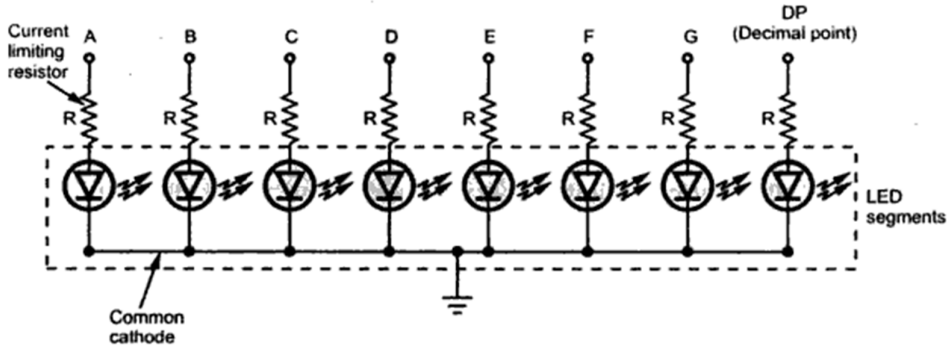
The two types of seven segment display are available-

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.



d) A 200 kVA, 3300/240 V, 50 Hz single phase transformer has 80 turns on secondary winding. Calculate :(i) Primary and secondary current (ii) Maximum value of flux (iii) Number of primary winding turns

Ans:

Given Data :

$V_1 = 3300$ $V_2 = 240$ $N_2 = 80$ $f = 50Hz$ $S = 200KVA$

(i) Number of primary winding turns = **(1 Mark)**

$$N_1 = \frac{V_1}{V_2} \times N_2$$

$$N_1 = \frac{3300}{240} \times 80$$

$$N_1 = 1100$$

(ii) Step: 3: To Find Primary Currents : **(1 Mark)**

$$I_1 = \frac{KVA \times 10^3}{V_1}$$

$$I_1 = \frac{200 \times 10^3}{3300}$$

$$I_1 = 60.60 \ A$$

Step: 4: To Find Secondary Currents : **(1 Mark)**

$$I_2 = \frac{KVA \times 10^3}{V_2}$$

$$I_2 = \frac{200 \times 10^3}{240}$$

$$I_2 = 833.33 \ A$$

(iii) Maximum value of flux: **(1 Mark)**

$$E_1 = 4.44 \phi_m \ f \ N_1$$

$$3300 = 4.44 \phi_m \times 50 \times 1100$$

$$\phi_m = 0.0135 wb$$

f) Compare the mechanical instruments and electrical instruments.

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

S.No.	Mechanical Instruments	Electrical Instrument
1	These instruments are used for static & stable condition. Or sensitivity of the electrical instrument is less	These instruments are used for rapid changes. Or sensitivity of the electrical instrument is more
2	They are unable to respond rapidly to measurement of dynamic & transient	They are able to record dynamic & transient condition.

	condition.	
3	Instruments are consists of moving parts that are rigid, heavy & bulky.	Instruments are consists of moving parts that are light in weight.
4	Weight is more.	Weight is less.
5	It produce noise & causes air pollution.	It doesn't produce noise during measurement.
6	Slowly indicates output.	Rapidly indicates output.
7	Life of the mechanical instrument is more	Life of the electrical instrument is less

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

a) Define the following terms : (i) Current (ii) Resistance (iii) Magnetic flux (iv) Reluctance

Ans:

(i) Current: **(1 Mark)**

It is defined as the movement of free electrons or flow of electrons inside a conducting material. It is denoted by I and measured in ampere.

OR $I = Q/t$

Where,

I = Average current in amperes , Q = Total charge flowing

T = Time in seconds required for the flow of charge

Units: – *coulomb* / sec. *or Amperes.*

ii) Resistance with their: **(1 Mark)**

It is defined as the opposition offered by a conductor to the flow of current. It is represented by R

OR The formula for resistance is given by

R= $\rho \times (l/a)$ OR R=V/I

Unit – ohm

iii) Magnetic flux (ϕ) :- **(1 Mark)**

The total number of lines of force comprising the magnetic field is called magnetic flux

φ = *Its unit is Wb*

iv) Reluctance (s) :- **(1 Marks)**

Reluctance is the property of the substance which opposes the creation of flux in it.

b) Compare insulated and earthed return system.

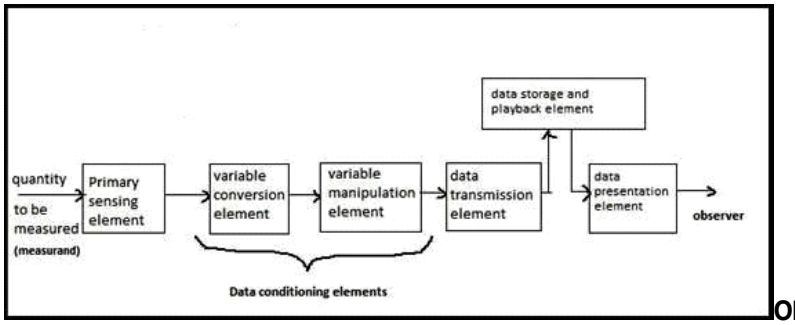
Ans: **(1 Mark each point)**

Sr.No	Insulated Return	Ground Return
1	Actually wire is used a return path for current	Actually ground is used as a return path for current No wire is required
2	Number of wires require Two	Number of wire required one
3	There is no disadvantage such as steel which is underground get rusting when insulated wire is used as a return path	If ground is used as a return path than there is disadvantages such as steel which is underground get rusting
4	Cost is more	Cost is less

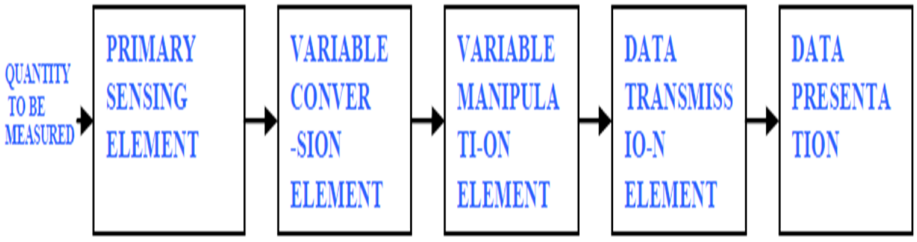
c) Draw the block diagram of 'General Measurement System'.

Ans: **(4 Mark)**

Block Diagram of General measurement system:-



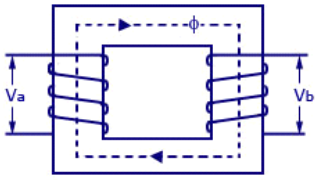
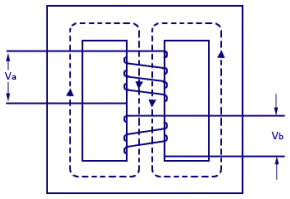
OR



OR Equivalent Fig

d) Compare between core type transformers with shell type transformer. (4 points)

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) Draw neat circuit diagram of full wave rectifier. Describe how current flow in both half cycles. Draw input output voltage waveform.

Ans: **(Diagram -2 Mark, Explanation- 2 Marks , input and output waveforms -2 Mark)**

Working of center tap full wave rectifier:

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.

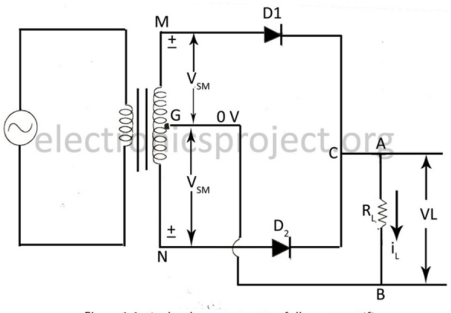
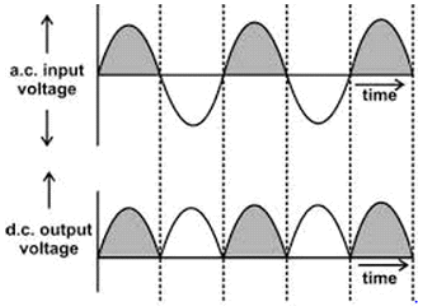


Figure 1-1: single-phase center-tap full-wave rectifier

or equivalent figure

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.

Input and output waveforms in diagram -



or equivalent figure

b) Define the terms multiplexer and de-multiplexer. Draw Schematic diagram of 1 : 4 de-multiplexer.

Ans:

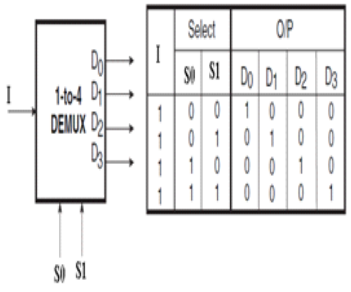
i) Multiplexer: **(2 Mark)**

Multiplexer has multiple inputs and one output. i.e. it accepts several data inputs and allows only one of them at a time. The routing of desired data input to output is controlled by select lines.

ii) de-multiplexer: **(2 Mark)**

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

Schematic diagram of 1 : 4 de-multiplexer: **(2 Mark)**

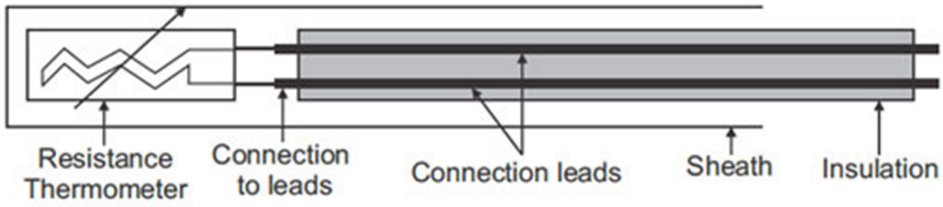


I	Select		O/P			
	S0	S1	D0	D1	D2	D3
1	0	0	1	0	0	0
1	0	1	0	1	0	0
1	1	0	0	0	1	0
1	1	1	0	0	0	1

or equivalent dia.

Q.5	Attempt any Four of the following: 16 Marks
a)	**Describe construction and working of RJD.**
Ans:	In case some questions credit may be given by judgment relevant answer based on candidate understands

9) Construction : **(Allotted 2 Marks)**



RTD construction

Working principle of RTD:- **(Allotted 2 Marks)**

The resistance of the material used to manufacture RTD depends upon temperature. As temperature changes resistance of RTD gets changed, the main principle of operation of an RTD is that when the temperature of an object increases or decreases, the resistance also increases or decreases proportionally (RTDs are normally PTC type).

$$R = Ro\ (1+\alpha\ t)$$

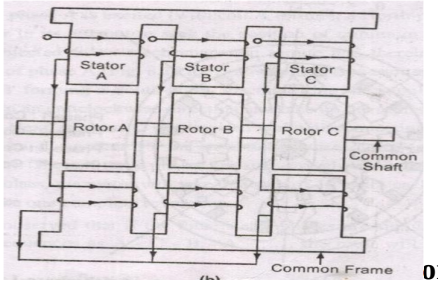
The main difference between a RTD and a **Thermistor** is that the sensing element used in a RTD is a metal and a thermistor uses ceramic or polymer material. As platinum is the most commonly used metal for making RTD's, the device can also be called Platinum Resistance Thermometers (PRT's).

b)	**State the types of stepper motor and describe any one.**

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

1) Variable Reluctance Motor
2) Permanent Magnet Motor

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



or equivalent dia.

Working:-

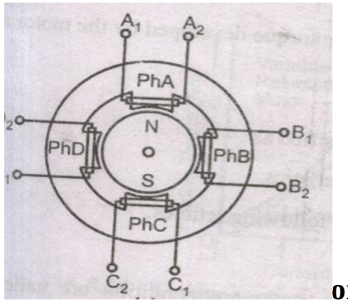
When phase A is excited rotor attempts minimum reluctance between stator and rotor and is subjected to an electromagnetic torque and there by rotor rotates until its axis coincides with the axis of phase A.

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.

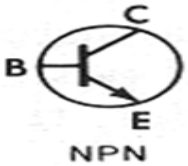
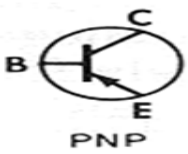
Working :-

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.

c) Compare between PNP transistor and NPN transistor.

Ans: **(Each Parameter: 1 Mark)**

.

Sr.No.	Parameter	NPN transistor	PNP transistor
1	**Symbol**		
2	**Direction of Emitter current**	As shown in the symbol	As shown in the symbol
3	**V_{CE}**	**V_{CE}**= $-V_{BC}+V_{BE}$, emitter is at lower potential.	**V_{EC}** = $V_{EB}-V_{CB}$, Emitter is at higher potential
4	**Application**	Voltage amplifier & switch	Power amplifier , push-pull power amplifiers

d) What is positive return system and negative return system ?

Ans:

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

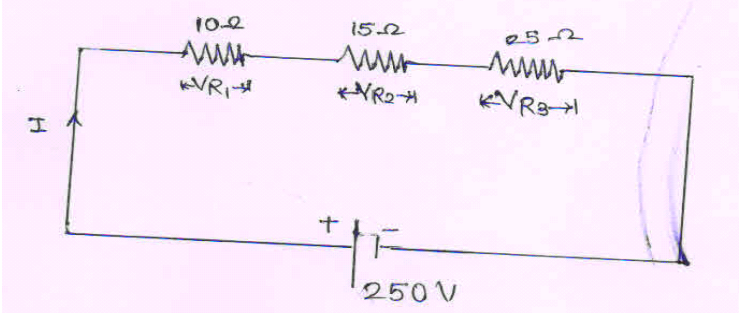
1. Tends to generate excessive system gain, noise, narrows bandwidth, and can cause oscillation.
2. Creates instability and tends to drive a system into its nonlinear region of operation.
3. Whereas negative feedback reduces system gain and increases bandwidth. Positive feedback increases system gain,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

e) Three resistance 10 ohm, 15 ohm and 25 ohm are connected in series and the potential difference across them is 250 V. Find(i) Equivalent Resistance of circuit. (ii) Total current of the circuit. (iii) Voltage drop across each resistance

Ans:



(1 Mark)

i) Equivalent Resistance of Circuit: **(1 Mark)**

$$R_{eq} = R_1 + R_2 + R_3$$

$$R_{eq} = 10 + 15 + 25$$

$R_{eq} = 50\ ohm$

ii) Total Current of the circuit: **(1 Mark)**

$$I = \frac{V}{R\,eq} \quad \ldots\ldots\ldots\ldots By\ ohm's\ \ law$$

$$I = \frac{250}{50}\ .$$

$$I = 5\ \ Amp$$

iii) Voltage drop across each resistance: **(1 Mark)**

$$a)\ V_{R1} = I\ \times R_1\ = 5 \times 10\ = 50\ volt$$

$$b)\ V_{R2} = I\ \times R_2 = 5 \times 15\ = 75\ volt$$

$$bc)\ V_{R3} = I\ \times R_3 = 5 \times 25\ = 125 volt$$

f) Draw the symbols and truth table for NOR and NAND.

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

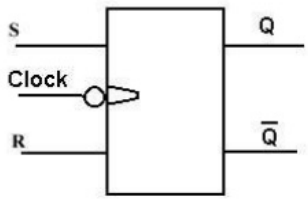
NOR gate

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

NAND gate

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

Q.6	**Attempt any Four of the following:**	**16 Marks**
a)	**Draw the symbols and truth table of R-S and D-flip-flop.**	
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

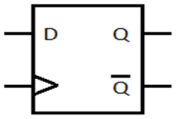


Table of truth:

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

b)	**State Faraday's Law of electromagnetic induction.**
Ans:	**Faraday's law of electromagnetic induction:**

i) First Law: - Whenever change in the magnetic flux linked with a coil or conductor , an emf is induced in it. **OR** Whenever a conductor cuts magnetic flux, an emf is induced in conductor. ---------- **(2 Marks)**

ii) Second Law :- 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

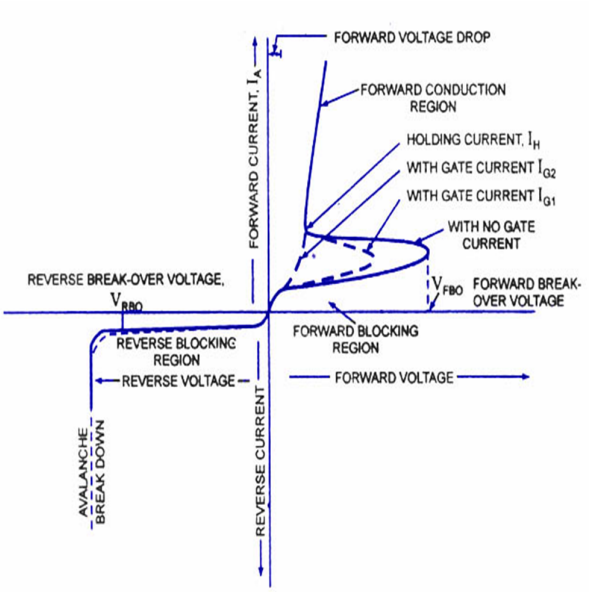
$\frac{d\phi}{dt}$ = Rate of Change of flux ---------- **(1 Marks)**

iii) Magnetic effect of electric current. **(1 Marks)**

Magnetic effect of electric current is one of the major effects of electric current in use, without the applications of which we **cannot have motors** in the existing world. A current carrying conductor creates a magnetic field around it, which can be comprehended by using magnetic lines of force or magnetic field lines.

c) Draw & explain V-1 characteristics of SCR. Define latching current and holding current.

Ans: **VI characteristics of SCR :** **(2 Marks)**



V-I Characteristics of SCR **or equivalent figure**

Explanation:-

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.

(1) Holding current : **(1 Marks)**

It is the minimum anode current required to maintain SCR in the on state.

(2) Latching current: **(1 Marks)**

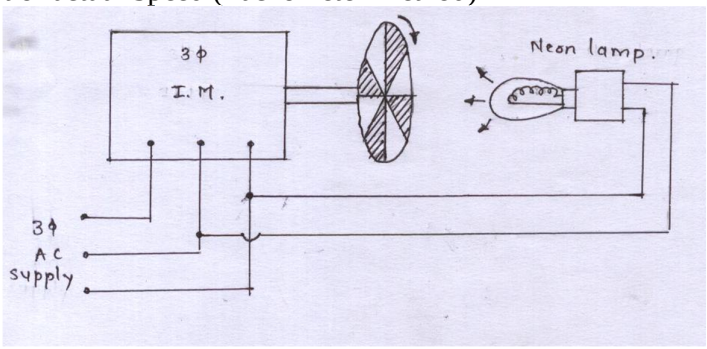
It is the minimum anode current required to maintain SCR in the on state immediately after gate pulse is removed and SCR is turned on.

d) Draw a neat sketch of stroboscope and describe working to measure speed of induction motor

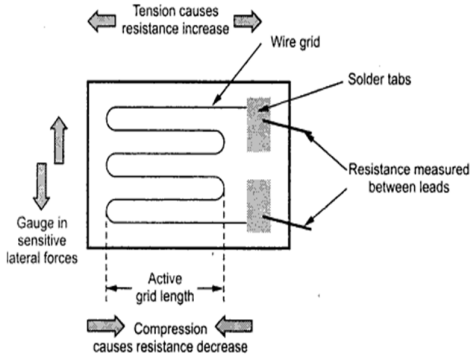
Ans: **(Diagram : 2 Marks & Working : 2 Marks)**

Methods of Speed Measurement:-

1. Measurement of actual Speed (Tachometer Method)



In the stroboscopic method a disc with alternate black and white sectors (painted) is attached to the end of the motor shaft. The number of black sector as well as white sectors, each is equal to the number of poles for which the motor is wound. For example for a 6-pole motor there will be 12 sectors, 6 black and 6 white, for testing motor with different numbers of poles, separate disc having different numbers of sectors (painted) is required.

	The disc is laminated by means of a neon lamp of stroboscope. The frequency of neon lamp is adjusted till the disc appears stationary; when disc would be appeared stationary at that time the frequency of the stroboscope corresponds to slip frequency. The slip is noted from the calibrated dial or the stroboscope.
e)	**Describe the working of strain gauge load cell.**
Ans:	**Strain Gauge load Cell:- Construction:** **(Figure -2 Mark & Working: 2 Mark)**  **or equivalent dia.** **Working-** This is consists of a fine wire element is loop back and forth on mounting plate (base). A tensile stress tends to elongate the wire and thereby increase its length and decreases its cross-sectional area. The combined effect is an increase in resistance. The strain of wire grid is measured with the Wheatstone bridge connecting the gauge in one of the four arms. When the force is applied on load cell, the resistance of load cell changes in accordance with the applied force.

---------- **END**----------