Important Instructions 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 principal components indicated in the 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 of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

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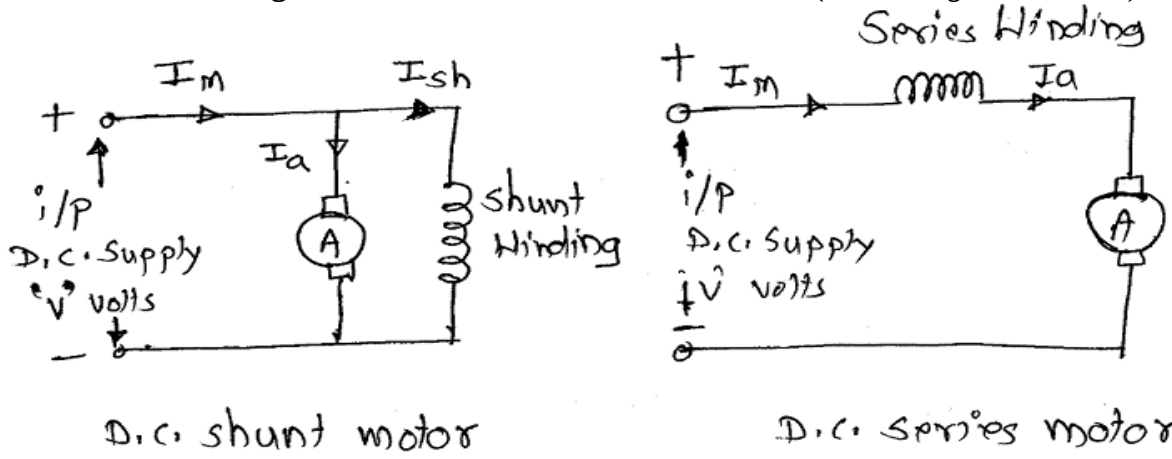
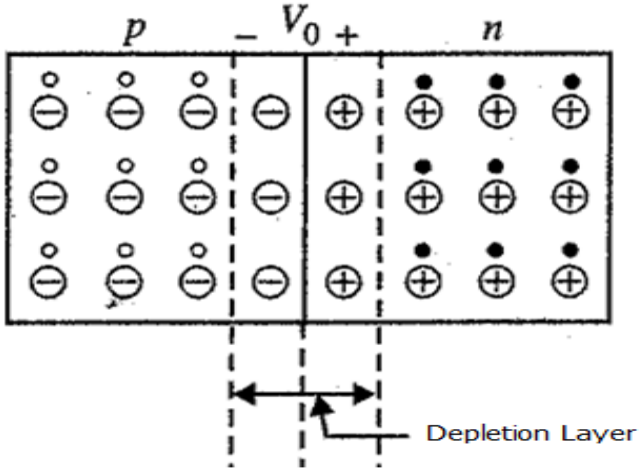
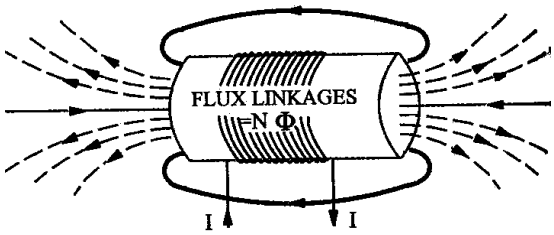
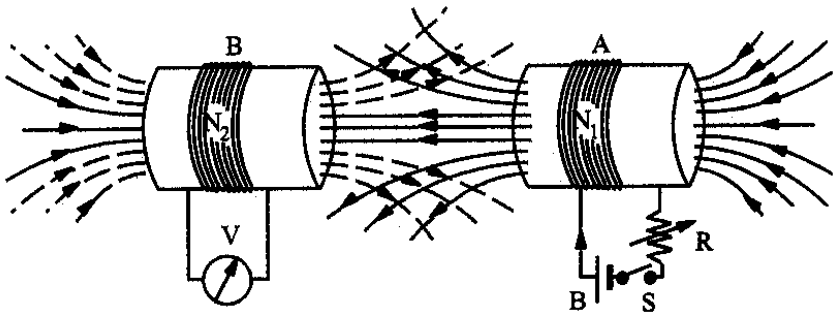
	Marks
I. A) Attempt any 3 of the following :	**12**
i) Define the following terms and give their unit also: 1) Emf 2) Current 3) Resistance 4) Potential difference	4
Answer: Definition: *(Note: Each definition with its unit carries 1 mark)* **1) Emf**: It is the force which creates potential difference across the terminals, by a source of electrical energy, to produce an electric current in a circuit. Unit- Volt (V) **2) Current:** It is defined as the rate of transfer of electric charge per unit time or current is flow electrons. Unit-Ampere (A) **3) Resistance**: It is a property of substance by virtue of which it opposes the flow current through it. Unit- Ohm (Ω) **4) Potential difference**: The potential difference between two points, say A and B, is a measure of the energy used by one coulomb in moving from A and B. Unit- Volt (V)	1 1 1 1
ii) Draw a neat schematic diagram of DC shunt and DC series motor.	4
Answer: Schematic diagram of DC shunt and DC series motor *(Each diagram 2 Marks)*  	4

iii) State the importance of colour code in automobile electric wiring.	4
Answer: Importance of colour code in automobile electric wiring: It is worth mentioning that the wiring of present days automobiles has become quite complex because of the use of the number of additional electrical equipments and accessories as compared with the earlier automobiles. However with the use of coloured cables, wiring installation has been simplified as much as possible. In order to quickly identify and also to simplify the wiring system, the cables are coloured. In addition colour lines or threads are also used around the cables which provide a very wide choice of colour combinations. There are seven main colours namely brown, green, white, blue, red & black etc. 1. Brown: For battery circuit, Radio set, Socket & battery auxiliaries 2. Yellow: Dynamo circuit, Form dynamo circuit to corresponding circuit box 3. White: Used for all ignition circuits & all electrical components, Electrical petrol lamp starter solenoid switch. 4. Green: Employees for all the auxiliary circuits fed through the ignition switches and protected by the ignition auxiliary fuse. 5. Blue: Used for the head lamp circuits and fed form the terminals on the lighting switch. 6. Red: Used for all sides of tail lamp circuits fed from the terminal on the lighting switch, Fog lamp panel light & other lamps which are required only when the side lamps are in use. 7. Black: Used for earth circuit return however the component is not earthed a cable must be taken to a good earthing point on the chassis.	4
iv) Define the term depletion Region with suitable diagram.	4
Answer: Definition of depletion Region: The area around the junction which is depleted of charge carriers (free electrons and holes) due to diffusion, across the junction is called as depletion region.	2
 Fig : Depletion region	2

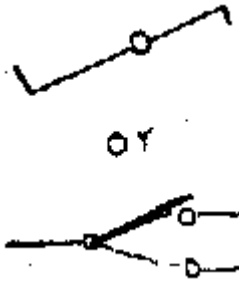
B) Attempt any one of the following :	6
i) Explain in details the concepts of self inductance and mutual inductance.	6
Answer: *(concept 2Marks each and diagram 1 Mark each)* **Self inductance:** The property of the coil due to which it opposes any increase or decrease of flux through it, is known as self inductance. Consider a coil of wire similar to the one shown in fig connected to a battery through a rheostat, it is found that whenever an effort is made to increase current through it, it is always opposed by the instantaneous production of counter e. m. f. of self induction. If now an effort is made to decrease the current, then again it is delayed due to the production of self induced e. m. f., this time in opposite direction.  Fig :Self inductance: **Mutual inductance:** If any change of current in coil A is always accompanied by the production of mutually induced e.m.f.in coil B. Mutual inductance may, therefore, be defined as the ability of one coil to produce an e.m.f.in a nearby coil by induction when the current in the first coil changes. This action being reciprocal, the second coil can also induce an e. m. f. in the first when current in the second coil changes. This ability of reciprocal induction is measured in terms of the coefficient of mutual induction M.  Fig :Mutual inductance	2 1 2 1
ii) Draw the graphic symbols for the following : 1) Earth 2) Two way switch 3) Variable resistance 4) Fixed capacitor 5) Transformer 6) Energy meter	6

Answer: Graphic symbols for *(One symbol carries one mark)*

1. Earth

1

2. Two way switch



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3. Variable resistance

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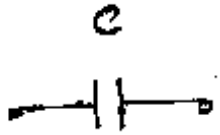
4. Fixed capacitor



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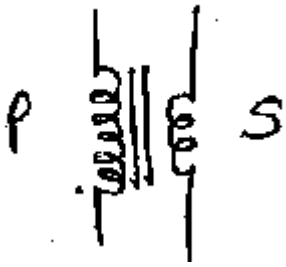
5. Transformer



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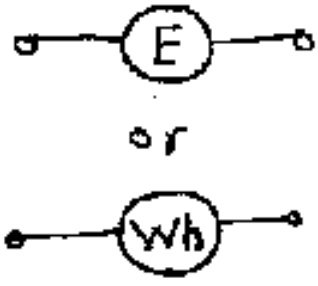
6. Energy meter



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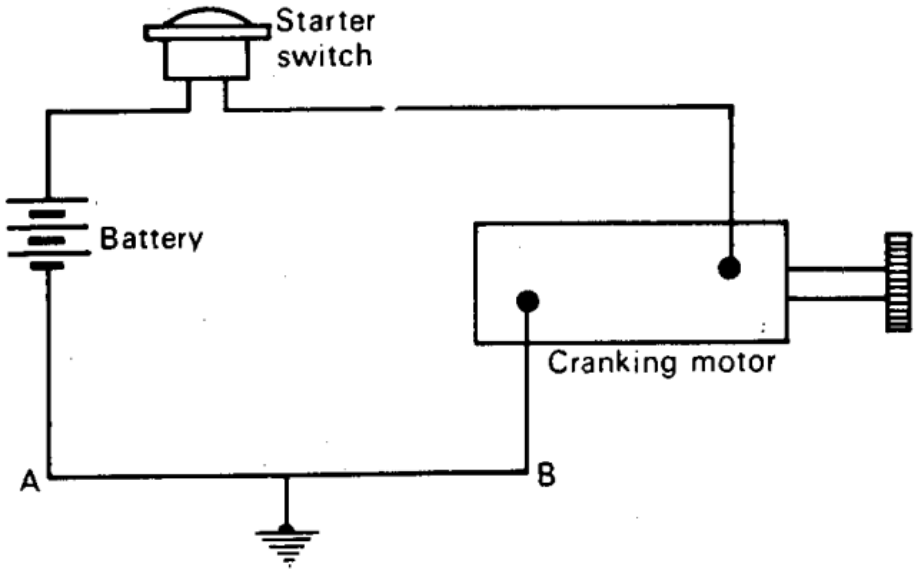
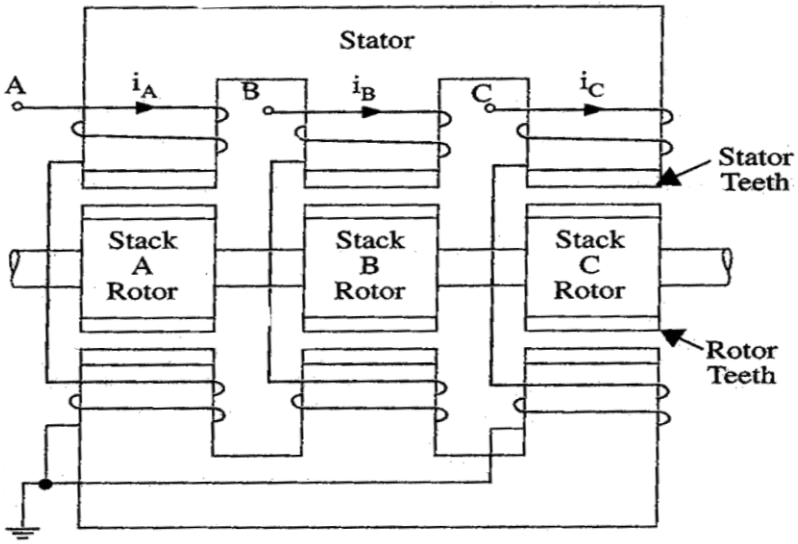
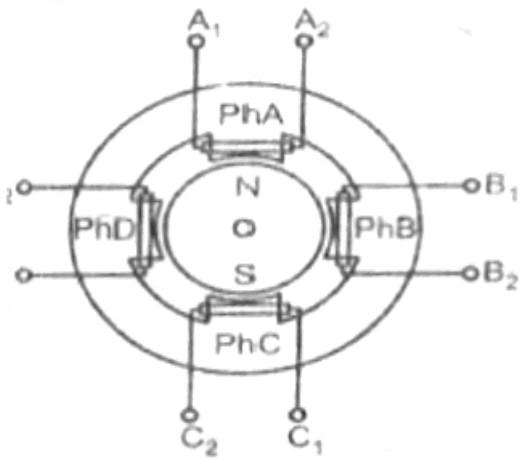
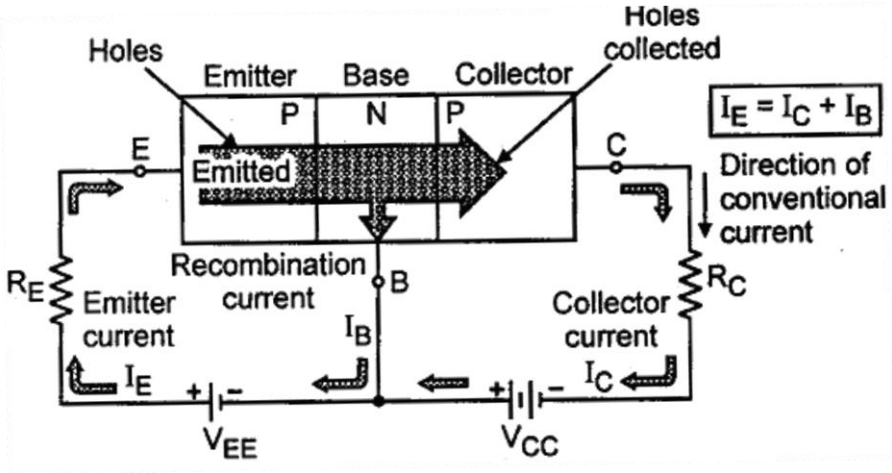
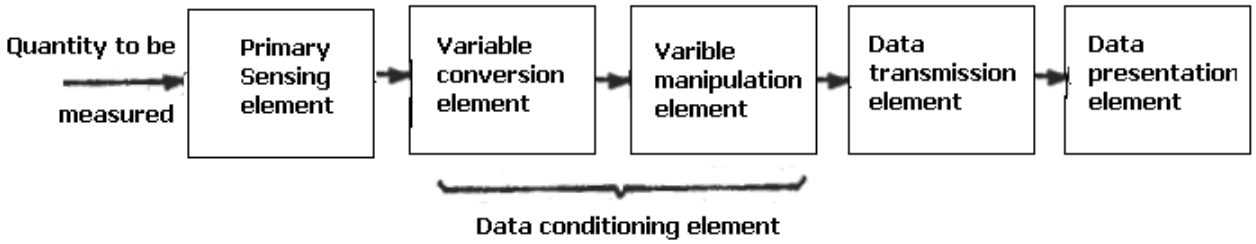
II. Attempt any four of the following :	16
i) Give the definition of the following: 1. Magnetic lines of force 2. Magnetic flux 3. Magnetic flux density 4. Reluctance	4
Answer: Definitions: *(One definition carries one mark)* 1) **Magnetic lines of force**: It is defined as a line along which an isolated N- pole would travel if it is allowed to move freely in a magnetic field. **2) Magnetic flux**: The total number of lines of force in any particular magnetic field is called magnetic flux. **3) Magnetic flux density**: The flux per unit area in a plane at right angles to the flux is known as flux density. **4) Reluctance**- It is defined as the opposition to the flow of flux in material.	1 1 1 1
ii) Describe with necessary diagram the wiring system for ground return system.	4
Answer : *(Description 2 Marks and diagram 2 Marks)* The use of fully insulated cables was made for electrical units in the wiring system of earlier automobile just like the domestic and industrial wiring system. Figure show a simple circuit of a car engine cranking motor having insulated connecting cables. The insulated return system or ground return system is much more dependable under road shops and conditions of vibration. It is for this reason that insulated return system is used in many commercial vehicles. In the case of insulated return system a single failure to the metal earth of the vehicle does not put the complete electrical system out of action except the concerned unit.	2
 Fig : Wiring system for ground return system	2

iii) With neat sketch, explain the construction of any one type of stepper motor.	4
Answer: **Construction of any one type of stepper motor***: (any one type - Explanation 2 Marks and Diagram 2 Marks)* **1. Variable Reluctance Motors**  	02
Construction: It is constructed from ferromagnetic material with salient poles. The stator is made from A stack of steel lamination and six equally spaced projecting poles each wound with an exciting coil. The rotor which may be solid or laminated as four projecting teeth of the same width as the stator teeth. There are three independent phases A, B and C and each one can be energized by direct current pulse from the drive circuit. Fig shows that if all the rotors are perfectly aligned with respect to themselves then the stator teeth of various stacks have progressive angular displacement	02
2. Permanent Magnet motor:-  	

Construction: It's stator construction is similar to that of the single stack VR motor. But the rotor is made of a permanent magnet material like "hard" ferrite. The stator has projecting poles but rotor is cylindrical and magnetized permanent magnet.	
iv) With the aid of neat diagram, explain the working of PNP transistor.	04
Answer: **Working of PNP Transistor***: (Working 2 Marks and Diagram 2 Marks)*  **Fig :** PNP transistor In this transistor the majority charge carriers are holes instead of electrons. The holes are emitted from the p-type emitter across the forward biased EB junction, into the base. It constitutes the emitter current I_E. In the lightly doped base there are very few number of electrons available for recombination. It constitutes the base current I_B. Therefore 2% of total emitted holes will flow out via the base terminal and the remaining near about 98% are drawn across the collector by the electric field at the reversed biased collector junction .It constitutes the collector current I_C. So the forward bias at the EB junction controls the collector and emitter current. In this way almost the entire current flows in the collector circuit. The emitter current is equal to the sum of collector and base current. $I_E = I_B + I_C$	02 02
v) Draw the block diagram of instrumentation system and state the function of each component.	04
Answer: *(Function 3 Marks and Diagram 1 Marks)*  Block diagram of instrumentation system Function of instrumentation system: 1) **Primary sensing element**- The quantity under measurement makes its first contact with the primary sensing element of measurement system. In other words measurand is first detected by primary sensor. The first stage of measurement system is known as a detector transducer stage.	1 3

2) **Variable conversion unit**- The output of the primary sensing element may be electrical signal of any form. It may be a voltage, frequency or some other electrical parameter. Sometimes this output is not suited to the system. For the instrument to perform the desired function, it may be necessary to convert this output to some other suited form while preserving the information content of the original signal.
3) **Variable Manipulation element**- The function of this element is to manipulate the signal presented to it preserving the original nature of the signal. Manipulation means only a change in numerical value of the signal.
4) **Data transmission element**- The signal conditioning and transmission stage is commonly known as intermediate stage. This stage is used to transmit the data from one place to another. The transmission of data may be in wired or wireless form.
5) **Data presentation element**-The information about the quantity under measurement has to be conveyed to the personnel handling the instrument or the system for monitoring, control, or analysis purposes. The information conveyed must be in a form intelligible to the personnel or to the intelligent instrumentation system. This function is done by data presentation element.

vi) Differentiate between L filter and C filter on the following parameters: — 04
1) Place of filter
2) Size of filter
3) Expression for ripple factor
4) Application

Answer: **Differentiate between L filter and C filter :** — 04

Sr. no	Parameter	L-filter	C-filter
1	Place of filter	In series with load	Across the load
2	Size of filter	Bulky	Small and compact
3	Expression for ripple factor	$RF = \frac{R_L}{3\sqrt{2}\ \omega \mathrm{L}}$	$RF = \frac{1}{4\sqrt{3}\ \mathrm{f\ C\ R_L}}$
4	Application	Heavy load	Light load

III. Attempt any four of the following: — 16

i) Discuss the working of piezoelectric transducer. — 04

Answer: **Working of piezoelectric transducer***: (Working 2Marks and Diagram 2 Marks)* — 02

Piezoelectric effect: Certain materials when mechanically strained generate within themselves an electric charge. This effect is called as piezoelectric effect. This effect is also reversible. This means that if a charge is applied, the material deforms mechanically. Such materials when subjected to alternating electric field will expand and contract alternatively.

Working: consider the above figure where a piezo crystal is sandwiched between two metal electrodes, if pressure or force is applied on the crystal then, the material deforms mechanically and generates electrical output which is proportional to applied force or pressure.

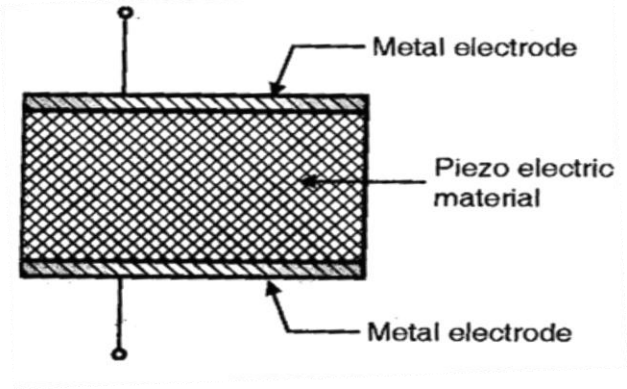


Fig : Piezoelectric transducer — 02

ii) a) State the principle of working of a DC motor. — 4
b) Draw the VI characteristics of SCR.

Answer: (DC motor principle 2 marks, VI characteristics of SCR 2 Marks)

a) **Principle of working of a DC motor:** When a electric current carrying conductor is placed in a magnetic field, mechanical force experienced on the conductor, the direction is given by fleming left hand rule and hence conductor moves in the direction of force. — 2

$$F = B.I.l$$

Where, B= field strength
I= current flowing in conductor
L= length of the conductor

b) VI characteristics of SCR — 2

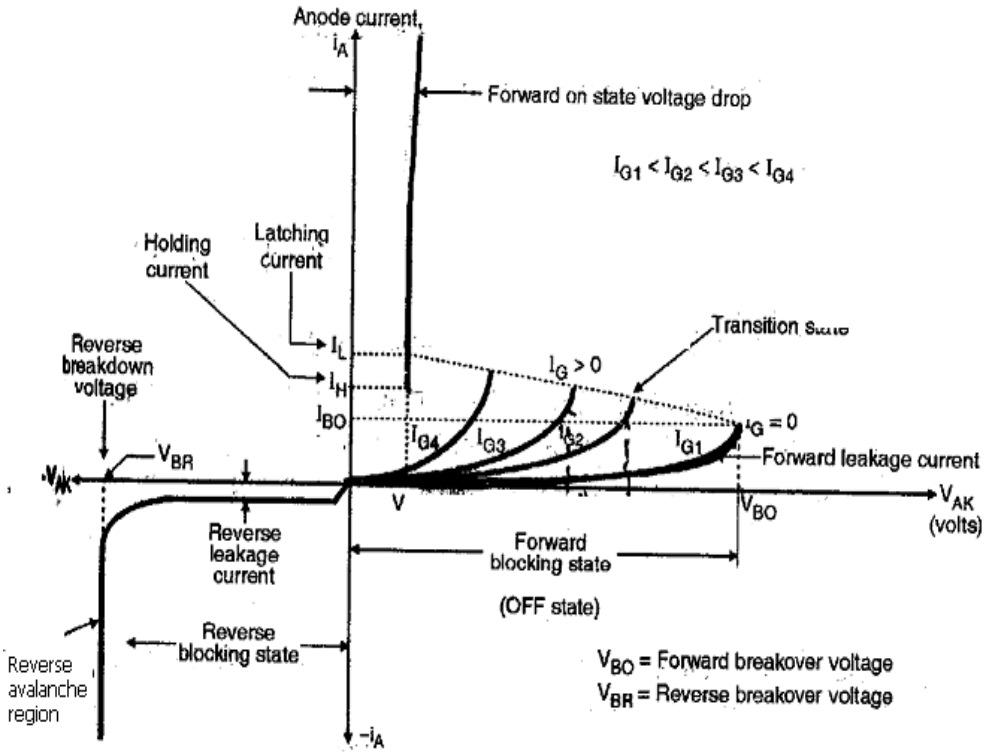
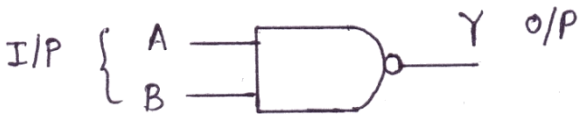
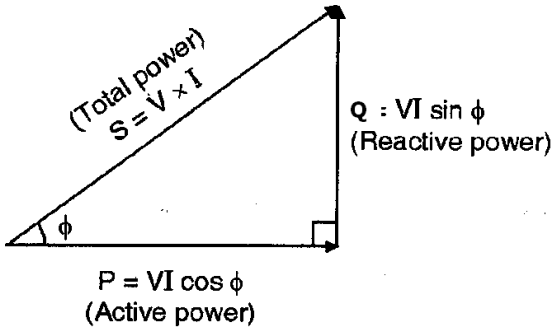
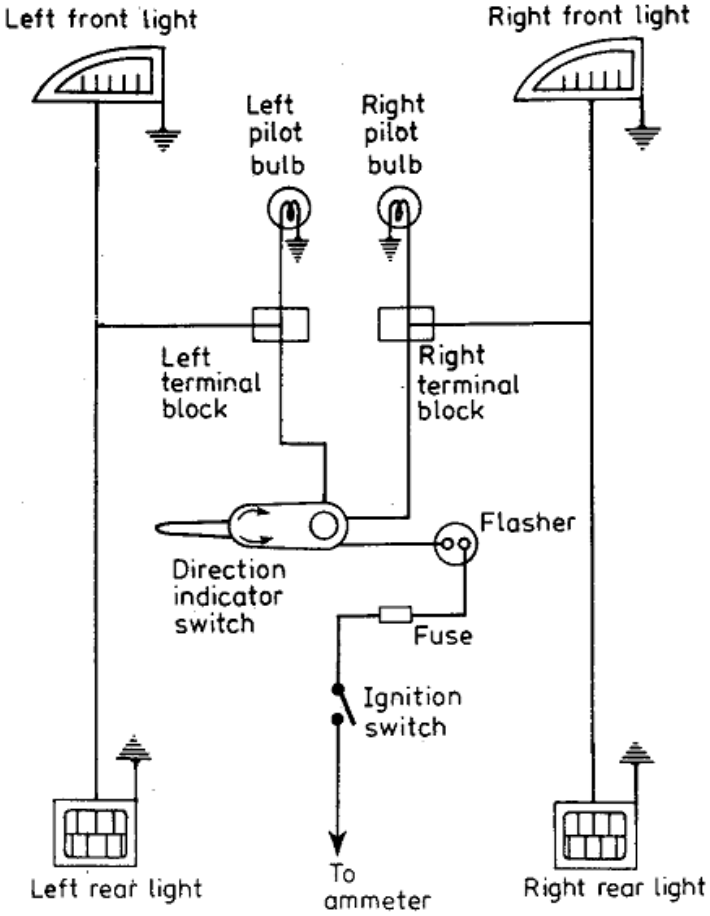
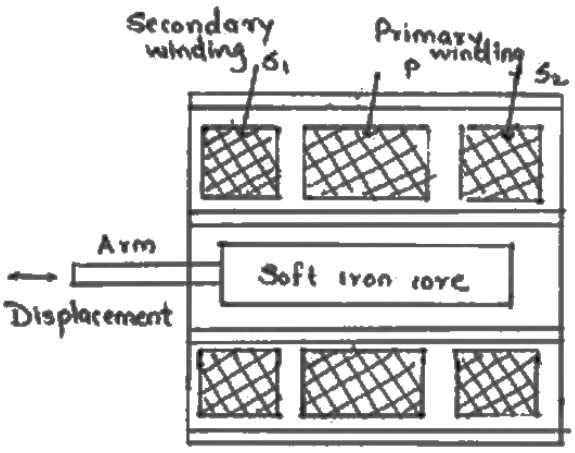
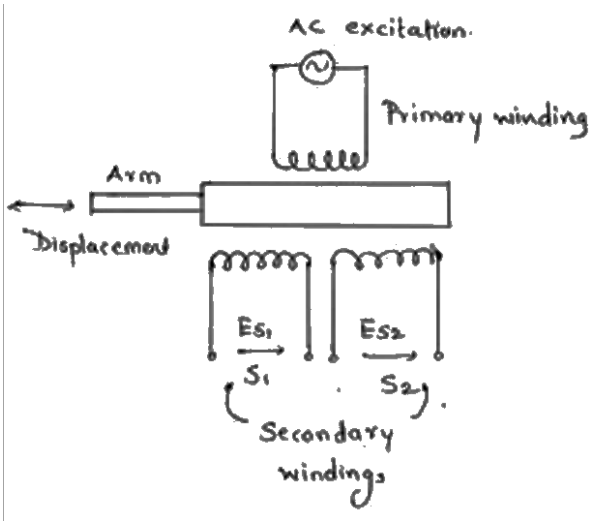


Fig : VI characteristics of SCR

iii) Draw the symbols of NAND gates. Give their truth tables.	4
Answer:(Symbol 2Marks, Truth table 2Marks)  2 inputs: A, B; Output Y= $\overline{A.B}$ 0 0 1 0 1 1 1 0 1 1 1 0 2	
iv) Draw and describe power triangle of AC circuit.	4
Answer: (Power Triangle 2 Marks, description 2Marks) The power triangle for RLC system is shown in fig.  2 The power triangle is a right angle triangle of which the base is power consumed in resistive element, vertical side is power consumed in reactive element & diagonal is total power. Apparent Power, $S = \sqrt{P^2 + Q^2}$, Unit VA or KVA Active Power, P or K = V x I x cosø , Unit Watt or Kw Reactive Power, Q = V x I x sin ø , Unit VAR or KVAR 2	
v) Define the following dynamic characteristics : 1) Speed of response 2) Lag 3) Fidelity 4) Dynamic error	4
Answer: **Definition**: *(1 Marks each)* 1. **Speed of response:** Speed of response is defined as the value of the rapidity with which an instrument responds to a change in the value of the quantity being measured. 1 2. **Lag:** It refers to retardation or delay in the response of an instrument to change in the input signal. 1	

3. **Fidelity**: It is defined as the degree to which a measurement system indicates changes in the measured quantity without any dynamic error. 4. **Dynamic error**: The difference between the indicated quantity and the true value of the time varying quantity if no static error is assumed is known as the dynamic error.	1 1
IV. A)Attempt any three of the following :	12
i) Define the following terms related to alternating quantity: 1) Waveform 2) Phase difference 3) Time period 4) Form factor	4
Answer: Definition: *(1 Marks each)* 1. **Waveform**: The shape of the curve obtained by plotting the instantaneous value against time. 2. **Phase difference**: It is the difference of phase between two alternating quantities. 3. **Time period**: The time taken in seconds to complete one cycle of an alternating quantity is called time period. 4. **Form factor:** It is defined as the ratio of rms value and average value for alternating currents and voltage.	 1 1 1 1
ii) Draw the wiring diagram for turn indicator and describe its function.	4
Answer: **Wiring diagram for turn indicator:**  Fig : Turn indicator	2

Turn indicator The direction indicators permit the driver to signal his intention to make a right or a left turn. Figure shows the circuit diagram of this type of direction indicator. When the signal lever is moved one or the other way, the circuit is completed between the battery and the proper indicating lights on the front and the rear of the vehicle as well as on the dash board. The circuit is completed through a flasher unit which is a device that closes and opens the circuit about 70 to 80 times per minute. This sends a flashing signal which is more noticeable than a steady light. The flashing action takes place because of the heating of a thermostatic blade in the flasher unit. When the blade is heated due to current flowing through the winding of the flasher, it wraps thereby opening a pair of contacts. It in turn opens the circuit. After this the blade cools and straightens to close the circuit.	2
iii) Describe the working of LVDT.	4
Answer: *(Any one diagram 2marks,working 2marks)* **LVDT (Linear Variable Differential Transducer):**  OR  Fig : LVDT LVDT is electromechanical transducer that can convert the rectilinear motion of an object to which it is coupled mechanically into a corresponding electrical signal. In LVDT motion of magnetic core changes the mutual inductance of two secondary coils relative to primary coil. It is based on a variable inductance principle for displacement measurements. It provides an ac voltage output proportional to the displacement of a core passing through its windings as shown in fig. **Function of LVDT for displacement measurement:** The operation of LVDT is based on position of core. The different cases of LVDT operation are: **Case1: core is at null position** The primary winding is connected to the ac source. Assume that the core is exactly at the centre of the coil. Due to equal flux linkage the secondary induced voltage are equal but they have opposite polarities. The output voltage e0 is therefore zero corresponding to the central position of the core. This position is called null position.	2 2 2

Case 2: Core is at left side

If the core is displaced from its null position towards secondary 1 i.e e01 then flux linked to secondary 1 e01 is increase and flux linked to secondary 2 e02 is decrease.

e0=e01- e02

Therefore the induced voltage e01 is greater than e02 and the output voltage of LVDT i.e e0 will be positive as shown in fig.

Case 3: Core is at right side

Similarly if the core is displaced from its null position towards secondary 2 i.e e02 then flux linked to secondary 2 e02 is increase and flux linked to secondary 1 e01 is decrease. Then e02 will be greater than e01 and the output voltage e0 will be negative as shown in fig.

e0= e02-e01

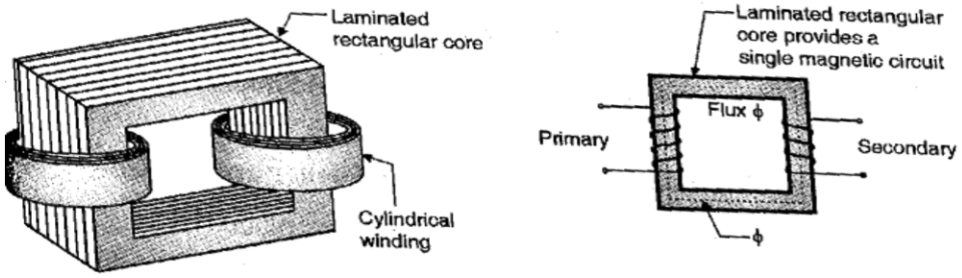
iv) What are the different types of transformer (constructional types)? Describe them with suitable diagrams. — 4

Answer :(Types 1 marks, Description 2 marks, Diagram 1 marks)

There are two different types of transformers

1. Core type
2. Shell type — 1

1. **Core type:** The construction of core type transformer is shown in fig. The core of this transformer is in form of rectangular frame made from laminations. It provides a single magnetic circuit as shown in fig. The primary and secondary windings are uniformly distributed on two limbs of the core. Both the windings are of cylindrical shape and they are arranged in a concentric manner with the low voltage winding placed near the core. — 1

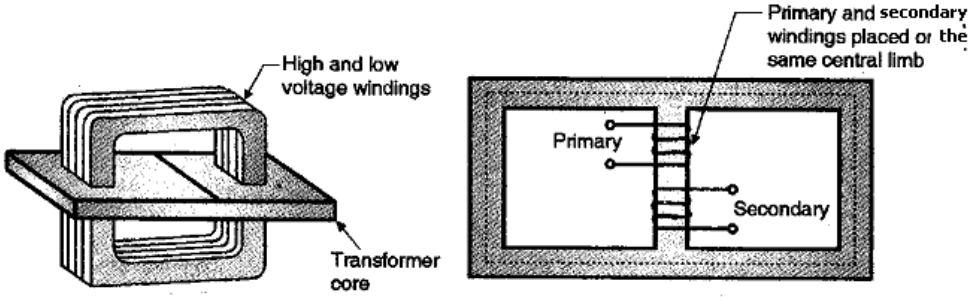


½

Fig : Core type

2. Shell type:

The primary and secondary windings are placed on the central limb of the core. The high voltage and low voltage windings are of sandwich type which is in the form of interleaved pancakes. This type of core provides double magnetic circuit. This type of core provides a better mechanical support and protection for the windings. — 1



(a) Shell type transformer **(b) Simplified diagram**

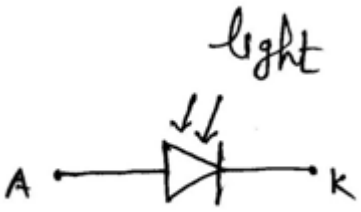
Fig. Shell type ½

4. **B)Attempt any one of the following** : 6

i) Draw the symbols of photodiode. Describe its working and give any two applications of the same. 6

Answer: *(Symbol-1Marks,operational diagram 1 marksWorking-2Marks, Application-2Marks)*

Symbol of Photo diode:



Symbol- Photodiode

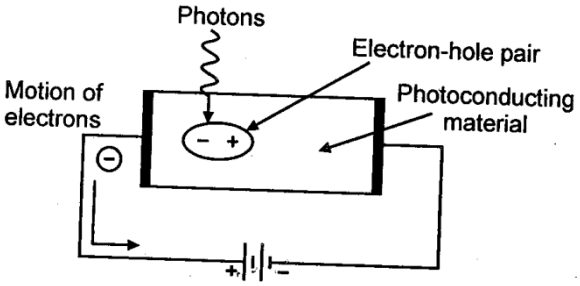


figure: operation of photodiode 2

Working:

1. The light is always focused through a glass lens on the junction of photodiode.
2. As the photodiode is reverse biased, the depletion region is quite wide, penetrated on both sides of the junction.
3. The photons incident on the depletion region will impart their energy to the ions present there and generate electron hole pairs. 2
4. The number of electron hole pairs will be dependent on the intensity of light. These electrons and holes will be attracted towards the positive and negative terminals of external supply, to constitute the photo current.
5. With increase in the light intensity, more number of electron hole pairs are generated and the photocurrent increases. Thus the photocurrent is proportional to the light intensity. 2

Applications of Photodiode: 1) It is used in Alarm circuits. 2) It is used in Counter circuit.

ii) a) List the necessity of multiplexers (any 2 points) 2
b) With the help of suitable block diagram, describe the operation of a multiplexer. 4

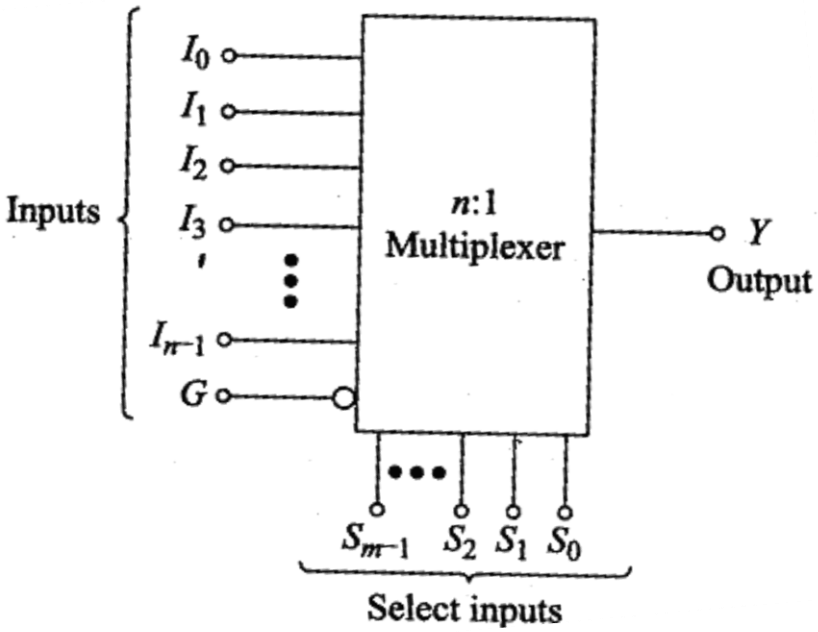
Answer (Necessity- 2 marks)

a) **Necessity of multiplexers**

1. In most of electronics systems, the digital data is available on more than one line. It is necessary to route this data over a single line. Under such circumstances we require a circuit which select one of the many inputs at a time. This circuit is nothing else but a multiplexer, which has many inputs, one output and some select inputs. 2

2. Multiplexer improves the reliability of the digital system because it reduces the number of external wired connections.

b) **Operation of a multiplexer**: (Operation- 3 marks,diagram-1marks)

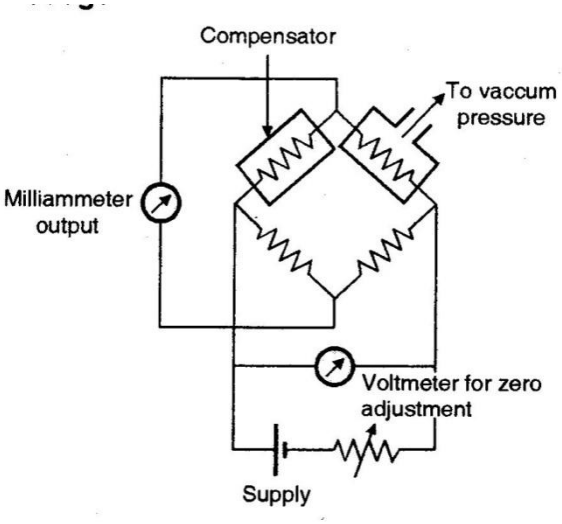
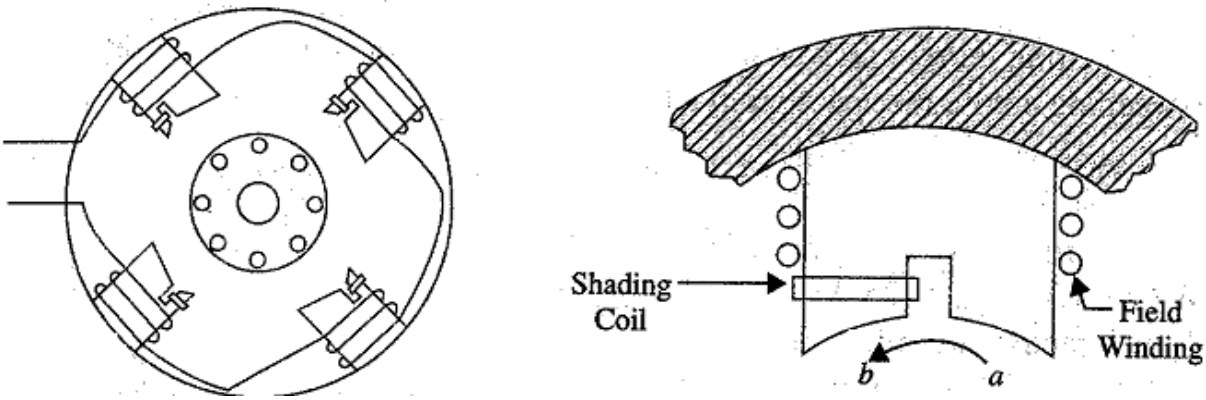


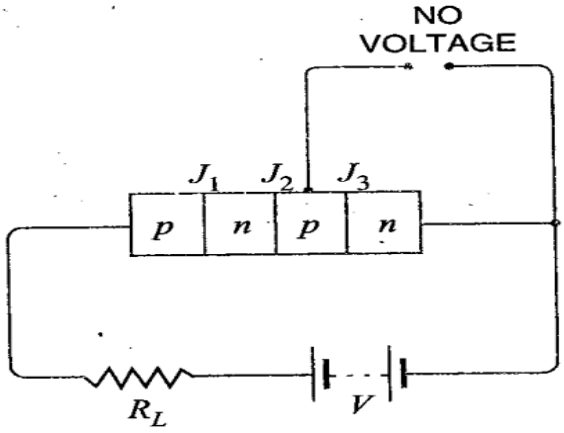
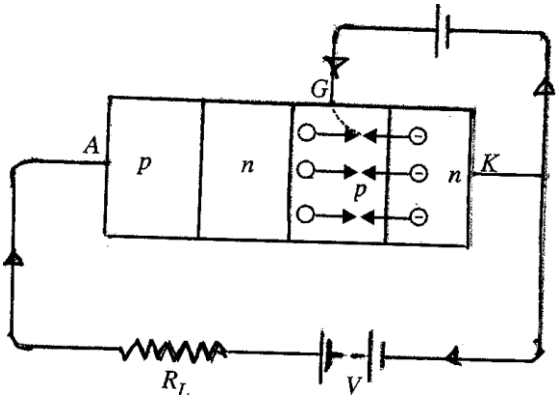
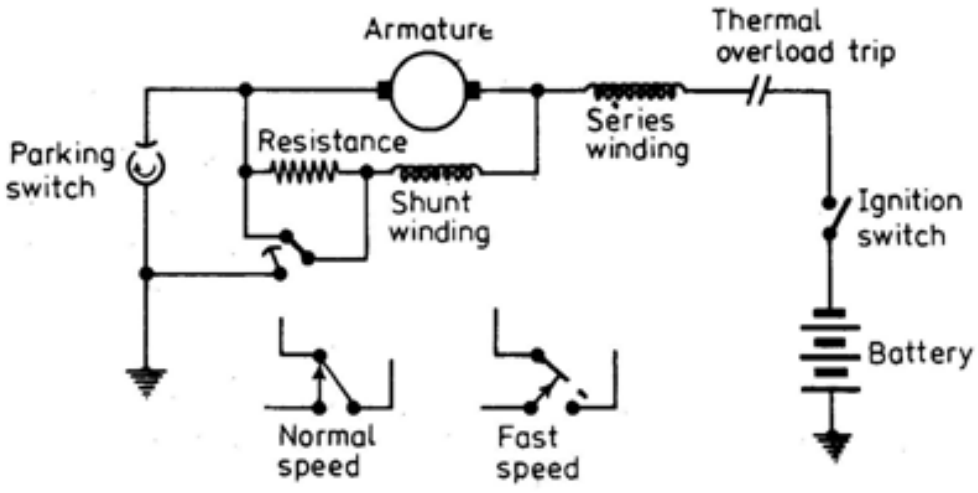
1

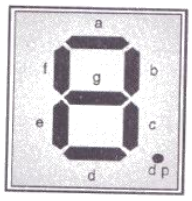
It is special combinational circuit that gets one out of several inputs to a single output and it is one of most widely used standard logic circuit in digital design. In a multiplexer the input selected is controlled by a set of select inputs. Fig shows the block diagram of a multiplexer with n input lines and one output line. For selecting one out of η inputs for connections to the output a set of m select input is required where $2^m = n$. Depending upon the digital code applied at the select inputs one out of n data source is selected and transmitted to a single output channel. Normally a strobe (or enable) input (G) is incorporated which helps in cascading and it is generally active low which means it performs its intended operation when it is LOW

3

Enable input	Select input		Output
G	S_1	S_0	Y
0	0	0	I_0
0	0	1	I_1
0	1	0	I_2
0	1	1	I_3
1	X	X	0

V. Attempt any four of following :	16
i) Describe in brief the working of Pirani vacuum gauge.	4
Answer: **Working of Pirani vacuum gauge**:  Figure. Pirani vacuum gauge	2
Working: As shown in the figure the thermal conductivity of the gas is measured by detecting the amount of heat lost from an electrically heated wire placed in a gas chamber. Heat is conducted from wire by conduction through the gas and greater the thermal conductivity of the gas, the lower will be the temperature of heater wire. As electrical resistance of heater element varies with temperature, that resistance of heater wire is a measure of pressure	2
ii) Draw a neat schematic diagram of shaded pole motor and give any two applications of the same.	4
Answer**:** *(diagram 2 marks , application 2 marks)*  Fig : Shaded pole motor	2
Applications: *(any TWO)* i) Used for small fan ii) Toys iii) Instruments iv) Ventilators	2

iii) Describe the principle of working of SCR with necessary sketches.	4
Answer: **Principle of working of SCR***: (working 2 marks, sketch 2 marks)* An SCR has two states that is either it does not conduct or it conducts heavily. Therefore SCR behaves like a switch. There are two methods to turn on SCR. First to keep the Gate open and make the supply voltage equal to the break over voltage. The second is to operate SCR with supply voltage less than break over voltage and then turn it on by means of small voltage, applied to the Gate. Applying small positive voltage to the gate is the normal way to close an SCR because the break over voltage is usually much greater than the supply voltage. To open SCR, reduce the supply voltage to zero.	2
 Figure. Without gate voltage  Figure: With gate voltage	2
iv) Draw and explain the wiring diagram of wind shield wiper.	4
Answer: **Wiring diagram of wind shield wiper**: *(Wiring diagram -2 marks & description – 2marks)*  Figure: Wiring diagram of Wind shield wiper	2
The motor operated wind shield wiper uses a motor of self-switching, two pole design, having a permanent magnet field system, together with gear box. Figure shows wiring of wiper with, DC compound wound motor used for circuit of wiper, showing normal & fast speed operation positions. When switch position is on **Normal Speed**	2

Position, series circuit of Resistance & shunt winding is in parallel with armature of motor. For this position motor gives normal speed. When switch position is on **Fast Speed Position**, only shunt winding is in parallel with armature of motor. For this position motor gives fast speed. The motor shaft is connected to blade through mechanical linkage with reduction gear box.	
v) A step down transformer operates on a 50 Hz ac supply with a primary voltage of 230 V. The cross sectional area of the core is 50 cm^2. Calculate : 1) The maximum flux ϕ m. 2) The maximum flux density Bm. 3) Voltage induced in the secondary side. Assume primary and secondary turns to be 500 and 250 respectively.	1 1 2
Answer: Given: V1 =230 V , f=50 Hz ,A=50 x 10^{-4} m^2 ,N1 =500, N2=250. **Solution:** 1) **The maximum flux ϕ m.** $E_1 = V_1 = 4.44 \times f \times \phi_m \times N_1$ $230 = 4.44 \times 50 \times \phi_m \times 500$ $\therefore \phi_m = 2.072 \times 10^{-3}\ Wb$ 2) **The maximum flux density Bm:** $B_m = \frac{\phi_m}{A}$ $= \frac{2.072 \times 10^{-3}}{50 \times 10^{-4}}$ $B_m = 0.4144\ T$ 3) **Voltage induced in the secondary side.** $E_2 = 4.44 \times f \times \phi_m \times N_2$ $E_2 = 4.44 \times 50 \times 2.072 \times 10^{-3} \times 250$ $E_2 = 115\ V$	1 1 2
vi) Describe the working of seven segment LED display.	4
Answer: **Working of Seven segment LED display:** Seven segment displays consists of Eight LEDs. Depending on the various digits and letters to be displayed the combination of LEDs are forward biased. e.g. suppose we want to display the digit 3 then LED a,b,c,d should only be forward biased the two type of seven segment display are available.  	2

There are two types – (consider any one) 2

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.

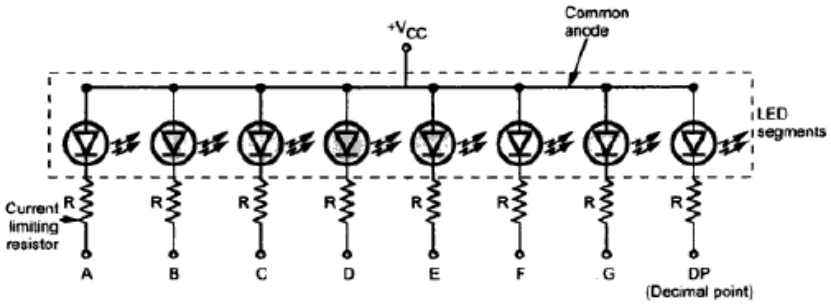


Fig : Common anode type

OR

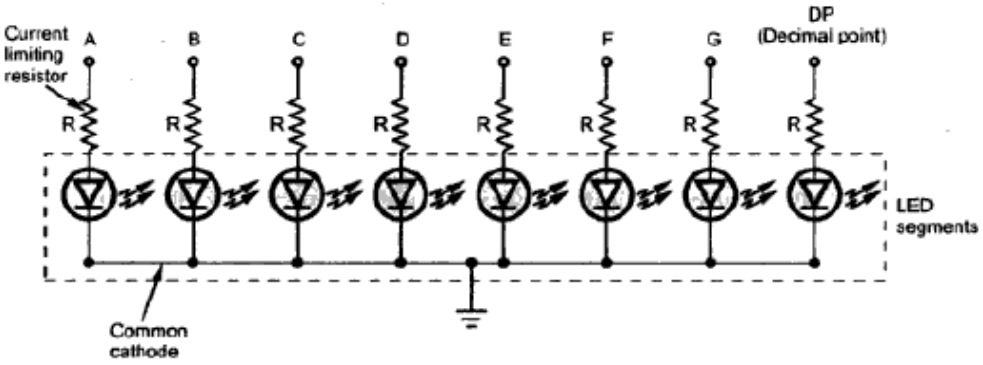
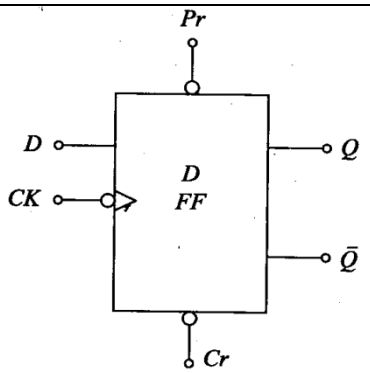
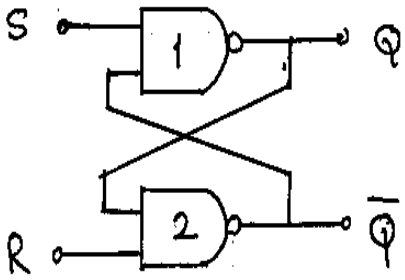


Fig :Common cathode type

6. Attempt any four of the following :	16
i) Define the terms gate and filp flop. Draw symbols of RS (Using NAND Gate) and D filp flop.	4
Answer: *(Definitions 2Marks, symbols 2Marks)* • **GATE** : A digital circuit with one or more input signals but only one output signal is called as a Logic Gate. • **FLIP FLOP**: The basic digital memory circuit, which is a bistable multi-vibrator circuit having two stable states, is known as a FLIP FLOP.	2



Symbol: D Flip-flop



S-R Flip-flop

2

ii) Compare series and parallel circuit on any four points. 4

Answer: Comparison of series and parallel circuit: *(Any 4- each point carry 1 Mark)*

Sr No.	Series Circuit	Parallel Circuit
1	All the resistors in series circuit carry the same current.	Voltage across each resistors connected in Parallel circuit is same.
2	The total voltage V applied across the series resistive circuit is sum of voltage drops across the individual resistors. V = V1 + V2 + V3 + ……	The total current I is sum of currents through the individual resistors. I = I1 + I2 + I3 + ……..
3	Equivalent Resistance R_T = R1 + R2 +R3+ ….. Rn	Equivalent Resistance $1/R_T$ =1/R1 +1/R2 + 1/R3 + ….. 1/Rn
4	Equivalent Resistance, R_T is higher than each individual resistance.	Equivalent Resistance, R_T is smaller than the smallest resistor connected in parallel circuit.

4

iii) Describe how amplification takes place in a transistor amplifier. 4

Answer: Transistor as an amplifier: *(Diagram 2Marks, Description 2Marks)*

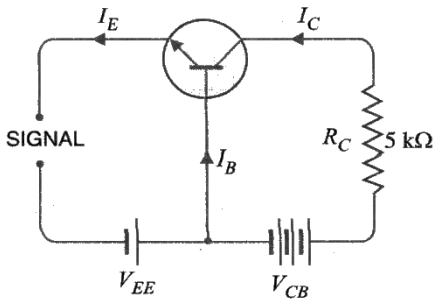
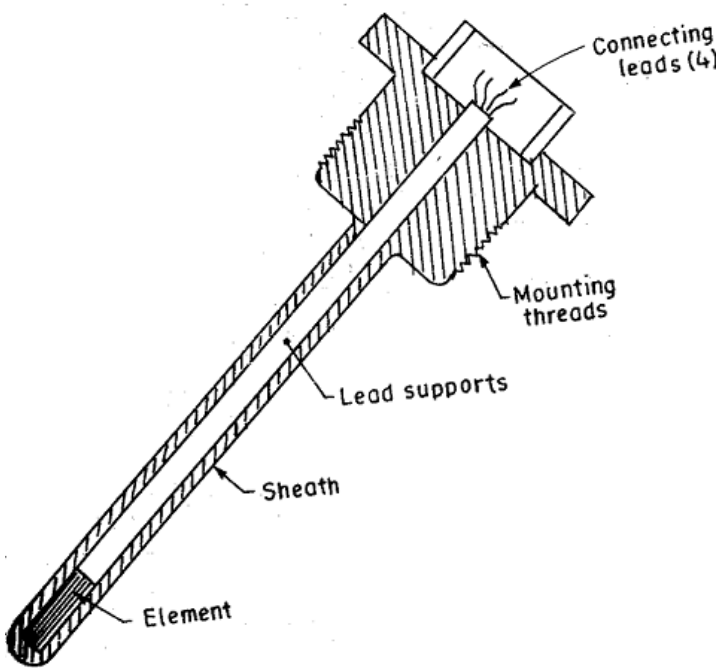
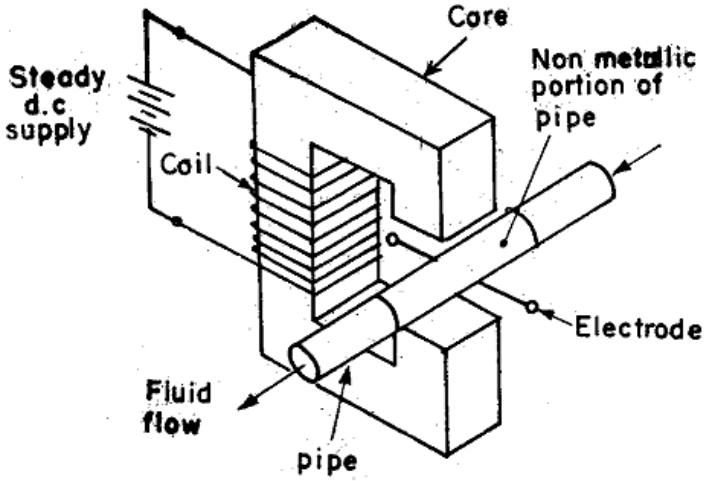


Fig Transistor as an amplifier

2

A transistor raises the strength of a weak signal and thus acts as an amplifier figure shows the basic circuit of a transistor amplifier. The weak single is applied between emitter –base junction and output is taken across the load R_C connected in the collector circuit. V_{EE} is applied in the input circuit in addition to the signal as shown. As the input circuit has low resistance, therefore a small change in signal voltage causes an appreciable change in emitter current. This causes almost the same change in collector current due voltage across it. Thus a weak signal applied in the input circuit appears in the amplified form in the collector circuit. It is this way that a transistor acts as an amplifier	2
iv) Draw a neat labeled diagram of RTD and state its operating principle.	4
Answer: *(Diagram 2 marks ,principle 2marks)*  Figure: RTD **Resistance thermometer:** The resistance of a conductor changes when its temperature is changed. The resistance thermometer or RTD is an instrument used to measure electrical resistance in terms of temperature. The relationship between resistance and temperature is given by : $R_t = R_o(1+\alpha\ \Delta t)$ Where, R_t - resistance at t temperature R_o - resistance at zero temperature α - temperature co-efficient Δt - temperature difference	2 2 2

v) Draw a neat diagram of electromagnetic flow meter and describe its working.	4
Answer: Electromagnetic flow meter: *(Diagram 2 marks, working 2 marks)*  **Fig :** Electromagnetic flow meter	2
Working: It consist basically of a pair of insulated electrodes buried flush in the opposite sides of a non-conducting, nonmagnetic pipe carrying the liquid whose flow is to be measured. The pipe is surrounded by an electromagnet which produces a magnetic field. The arrangement is analogous to a conductor moving across a magnetic field. Therefore, voltage is included across the electrode. This voltage is given by:- E= *Blv* volt Where, *B*= flux density; Wb/m2, *l* = length of conductor = diameter of pipe; m, And *v* = Velocity of conductor (flow); m/s Thus, assuming a constant magnetic field, the magnitude of the voltage appearing across the electrode will be directly proportional to velocity, i.e flow of fluid.	2