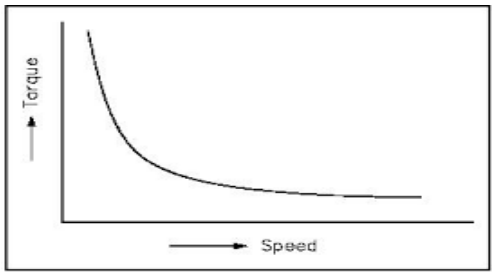
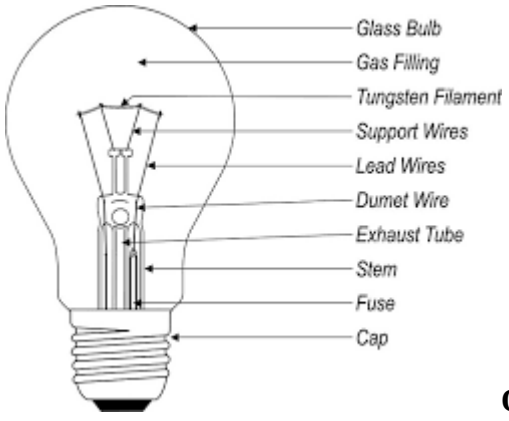
Important suggestions to examiners:

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.

SECTION — I

Q.1	**Attempt any NINE of the following: 18 Marks**
a)	**Find the current rating of fuse required for series circuit of two 100 w/200 V lamps.**
Ans	**Given Data:** P1 =100 W P_2 =100 W in series V = 200 V Total power P=P1+P2=100+100=200 W---------- **(1 Mark)** **Current supplied to the circuit:** $I = {}^{P}/_{V} = {}^{200}/_{200} = 1\ A$----------**(1 Mark)**
b)	**Two resistance of 10 Ω and 5 Ω are connected in parallel across 100 V dc supply. Find current and power supplied by DC source.**
Ans	**Given Data:** R_1 =10 ohm R_2 = 5 ohm in series V = 100 V **i) Effective resistance:** $R_T = {}^{R1 * R2}/_{R1 + R2} = {}^{10 * 5}/_{10 + 5} = 3.33\Omega$ ii) **Current supplied to the circuit:** $I = {}^{V}/_{R_T} = {}^{100}/_{3.33} = 30.3\ A$--------**(1 Mark)** iii) **Power supply by DC Sources :** $P = V * I = 100 * 30.3 = 3030\ Watt$--**(1 Mark)**
c)	**Define the terms :(I)Instantaneous value and(ii)Time period.**
Ans	**Instantaneous value:**----------**(1 Mark)** The Value of AC quantity at any particular time instant is called as Instantaneous value **Time period:**----------**(1 Mark)** The time (in sec) required by an alternating quantity to complete its 1 cycle is known as time period.Its Units: Second (sec.)

d)	**State the methods used for speed control dc shunt motor.**
Ans	**(Two methods expected each:1 Marks)** Speed control of DC Shunt motor is done by using following methods:- 1) Armature Voltage control 2) Flux control (Field control)
e)	**Draw Speed Vs Torque characteristic for DC series motor.**
Ans	**i) Speed-Torque Characteristics of D.C. Series motor:----------(Marks -2)**  $T \alpha \frac{1}{N}$
f)	**State any two chemical plant applications of DC shunt motor.**
Ans	**Application of D.C Shunt Motor:- ------(Any two applications expected each:1 Marks)** Shafts, Lathes machine, Vacuum cleaners, pressure blowers, constant head centrifugal pumps, compressor, reciprocating pumps, fans, wood working machine, Laundry washing machines, milling machines, passenger elevators, continuous conveyors, grinders, polishers, small printing presses, paper making machine etc.
g)	**"An induction motor cannot run at synchronous speed". Give justification.**
Ans	**Justification.: (Marks -2)** When the induction motor is supplied by 3-phase supply, the rotating magnetic field is developed. So there is a relative speed between field and rotor. It gives rise to change in flux and hence emf is induced in rotor. The small relative speed produces small induced emf. If an induction motor runs at synchronous speed, the relative speed is zero and no emf is induced. Therefore the motor will not run.
h)	**State any two applications R-split induction motor.**
Ans:	**Application of R-Split Induction Motor:--(Any two applications expected each:1 Marks)** R-split induction motor is used in fans, blowers, centrifugal pumps, washing machine grinder electrical tools, domestic refrigerator, oil burners etc.

i)	**What is ideal transformer? How it differs from practical transformer?**
Ans:	**(Each point carrying 1/2 mark)** 1. It is the transformer which dose not have any losses 2. Its efficiency is 100% 3. Its regulation is 0% 4. The value of resistances and leakage reactance's is zero for ideal transformer
j)	**Give classifications of transformer according to their construction.**
Ans:	Classifications of transformer according to their construction: **(Marks -2)** 1. Core type 2. Shell type 3. Berry type
k)	**List the different types of wire used in electrical wiring.**
Ans:	**Types of wire used in electrical wiring:** **(Any four Types Expected: 1/2 mark each)** i) VIR (Vulcanized Indian Rubber) ii) PVC (Polyvinyl Chloride) wires iii) T.R.S. Wire iv) Flexible wire v) Lead sheathed wires vi) CTS (Cab Tyre sheathed wires)
l)	**Draw construction of incandescent lamp.**
Ans:	**(Diagram without Labelling: 1 Mark & Neat Labelled diagram: 2 Mark)** **Construction Figure og incandescent lamp**  **Or equivalent figure**

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

a) **Compare single phase and three phase A.C. supply by four points.**

Ans: **(Any Four Point expected:1 Mark each)**

Parameter	Single phase A.C	Three phase A.C.
No. of Phase	One	Three
Rating	150% less than three phase	150% Greater than Single ph
Size of machine	Larger than Three phase machine	Three phase machine are alwa smaller and lighter
Self-starting of motor	Not self-starting	Self-starting
Cost	More	Less
Power factor	Low	High
Efficiency	Less	More
Maintenances	Less	More

b) **(i)State Ohm's law.**
(ii) State principle of electromagnetic induction.

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

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

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

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

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

II) 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. ----------**(Marks Allotted - 01)**

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

$\frac{d\phi}{\cdot}$ = Rate of Change of flux ----------**(Marks Allotted - 01)**

c)	**What is starter? State its necessity in DC motor.**
Ans:	**Starter----------(Definition:-2 Mark)** Starter is a device which connects with motor in series to decrease the current at starting time and increase current after starting the motor (in other words start or stop the motor) and provide overload protection. **Necessity of the starter:----------(2 Mark)** The current drawn by motor $I_a = \frac{V - E_b}{R_a}$, at start speed $N = 0$, $\therefore E_b = 0$ and $I_a = \frac{V}{R_a}$. As R_a is very small $I_a$will be dangerously high at the time of starting. This high starting current may damage the motor armature (& series field winding in the case of dc series motors). Hence to limit the starting current suitable resistance is inserted in series with armature which is called as starter. This starting resistance is cut-off insteps with increase in speed.
d)	**List the different parts of DC machine. State function of any two parts.**
Ans:	**Parts of DC Machine:----------(Any four parts expected: 1/2 Marks each)** 1) Yoke: 2) Pole Cores & Pole shoe: 3) Armature core: 4) Armature winding: 5) Commentator: 7) Brush: 8) Cooling Fan: 9) End covers: ➢ **Function :** ----------**(Any Two part expected: 2 Marks)** **1) Yoke:** The main frame of machine is called the yoke. The yoke serves the following two purposes. i) It supports the other components such as poles and provides mechanical protection for whole machine. ii) It forms a part of the magnetic circuit & provides the path of low reluctance for the magnetic flux.

2) Pole Cores& Pole shoe:

The pole core and pole shoe from an important part of the field system. The pole shoe serves two purposes

i) They spread out flux in the air gap & their large cross section reduces the reluctance of the magnetic path

ii) They support the exciting coils or field coils.

3)Armature core:

The armature cores, which is cylindrical or drum and built up of circular sheet discs or laminations is keyed to the shaft. It serves two purposes

i) Houses the armature conductors or coils and causes them to rotate, hence cut the magnetic flux

ii) Provides a low reluctance path to the flux through armature

4)Armature winding:

The armature winding consists of a large number of coil suitably connected together

5) Commutator:

The function of the commutator is to reverse the current in each conductor of the armature as it passes from one pole to another and thus to help the motor to develop a continuous and unidirectional torque

7) Brush:

Brushes are used to conduct the current to the commutator from the external circuit.

8) Cooling Fan:

In some machine, A fan is fitted to the shaft on the side opposite to that of the commutator for cooling purposes.

9)End covers:

These are attached to the ends of the main frame and contain bearings for the armature. The end cover on the commutator side also supports the brush assemblies.

e) State any four parts and their materials used for three phase induction motor.

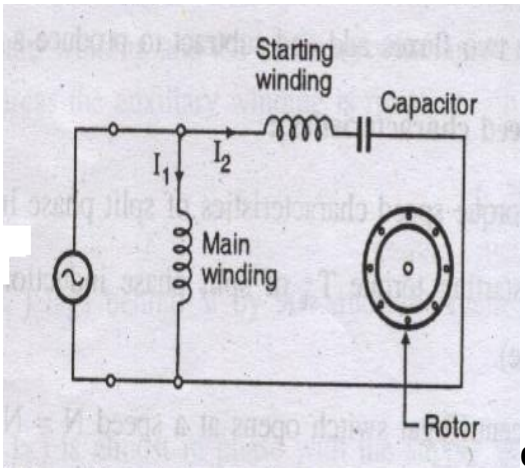
Ans:

Parts	Material
Stator frame	Cast iron or cast aluminum alloy
Stator core	Silicon steel
Rotor bars	Aluminum
Shaft	Steel
Slip ring	Graphite or metal contact brass ring
Slip ring brushes	Graphite or metal contact
Stator winding	Copper conductors
rotor winding	Copper conductors

(Any four parts expected: 1 Marks each)

f) With neat construction, explain working of C-split type of induction motor.

Ans: **Capacitor Split Induction Motor:-** **(Figure: 2 Mark & Working:2 Mark)**



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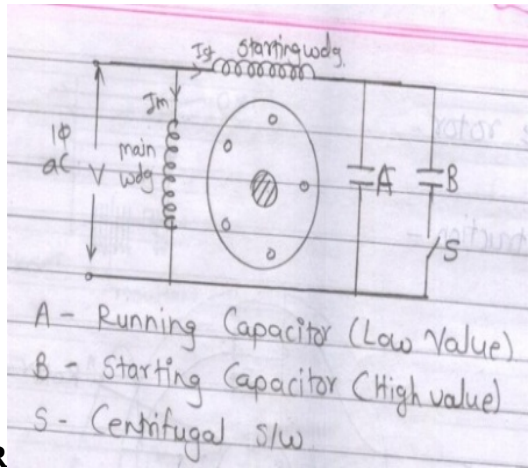


or Equivalent fig

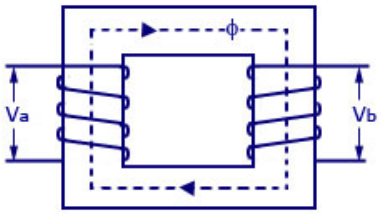
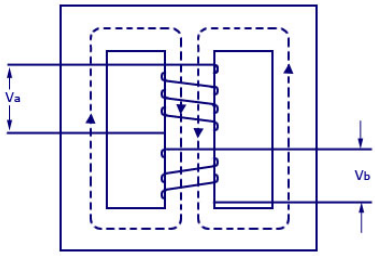
Working Principle:

In these motors one capacitor is connected in series with the auxiliary winding. There is no centrifugal switch. Thus this winding along with the capacitor remains energized for both starting and running conditions. Capacitor used serves the purpose of obtaining necessary phase displacement at the time of starting and also improves the power factor of the motor.

Q.3 **Attempt any FOUR of the following:** **16 Marks**

a) **Compare core-type and shell-type transformer by four points.**

Ans: **(Any Four points expected each:1 Marks)**

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

b) **For 12 KPA, 440 V/200 V, 50 Hz, 1 φ transformer, find:**
(i) Primary current (ii) Secondary current (iii) Turns ratio and
(iv) No. of turns on primary side.

Ans: **(Note: Data Insufficient)**

Given Data :- E_1= 440V , E_2=200V, S=12 KVA, f= 50Hz

- **Primary Current =** $I_1 \equiv \frac{KVA \times 1000}{V1}$

$$I_1 \equiv \frac{12 \times 1000}{440}$$

I_1= 27.27 **Amp** ---------- **(01 Mark)**

- **Secondary Current =** $I_2 \equiv \frac{KVA \times 1000}{V2}$

$$I_2 \equiv \frac{12\times1000}{200}$$

I_2= 60 **Amp**---------- **(01 Mark)**

- **Turns ratio** $K = \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{440}{200} = 2.200$ **or**

$$= \frac{N_1}{N_2} = \frac{I_2}{I_1} = \frac{60}{27.27} = 2.200$$----------**(01 Mark)**

- **No. of turns on primary** $K = \frac{N_2}{N_1} = 0.4545$

$$N_1 = 2.2 * N_2$$----------**(01 Mark)**

c) State working principle of ELCB. State its two applications.

Ans: **(Working: 2 Mark & Applications:2 Mark)**

ELCB:-

An Earth Leakage Circuit Breaker (ELCB) is a device used to directly detect currents leaking to earth from an installation and cut the power

There are two types of ELCBs:

1. Voltage Earth Leakage Circuit Breaker (voltage-ELCB)
2. Current Earth Leakage Current Earth Leakage Circuit Breaker (Current-ELCB).

OR

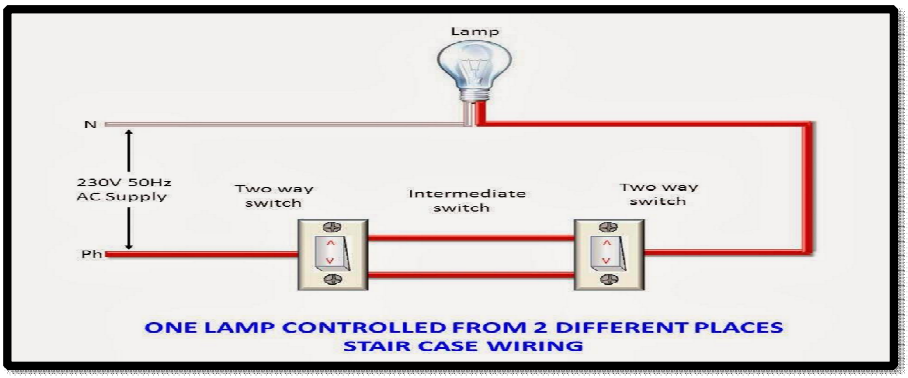
Earth leakage circuit breaker is a safety device used in electrical installations with high earth impedance to prevent shocks and disconnect power under earth fault conditions. Works on principle of relaying when the current in the earth path exceeds a set value. ELCB is used for protection against electric leakage in the circuit of 50 Hz or 60 Hz , rated voltage single phase 240 V, 3 ph. 4 kv. Rated current up to 60 Amp. When the earth fault occurs, the ELCB cuts off the power within the time of 0.1 sec. automatically to protect the personnel.

Under normal conditions (IL — IN) = If is very low or nearly zero. The CT surrounding the phase and neutral senses the differential current under earth fault and actuates the CB to operate (open). The difference current If through fault path resistance R_e is the leakage to earth. If this value exceeds a preset value then the CB opens. Normally it is around 35 mA for tripping in domestic installations with tripping time being as low as 25msec.

Application of ELCB:

It protects person against shock due to leakage current also it protects circuit/ equipment against overload and short circuit condition.

d)	**Draw the wiring diagram of staircase wiring and explain its working.**
Ans:	**(Figure: 2 Mark & Working:2 Mark)**



OR Equivalent figure

Working:-

The wiring of this type is accomplished on the principle that on-off operation of one lamp can be controlled by two switches. Therefore special type of switches as two way switches or single pole double throw (S.P.D.T.) switch are used .The wiring is as shown in the fig.

In this case, neutral wire is directly connected to one terminal of the lamp & the phase wire is connected to its other terminal through its two way switches S1 & S2 as shown in the fig. The table gives the position of switches & their respective lamp conditions. The lamp can be switched ON by any one of the two switches &&again switched OFF by any one switches. Thus single lamp is controlled from two places for connection it requires a lamp holder, two-way switches, connecting wires.

e)	**State need of earthing. List different types of earthing.**
Ans:	**Need of Earthing:** **(2 Marks)**

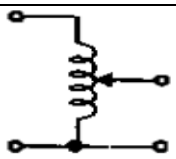
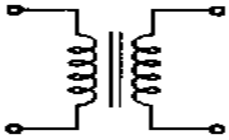
- Earthing provides protection to the electrical machinery due to leakage current.
- Earthing provides protection to Tall Building & structure against lightening stroke
- Earthing is protects human from shocks

Types of Earthing: **(2 Marks)**

1. Pipe type Earthing
2. Plate type erthing

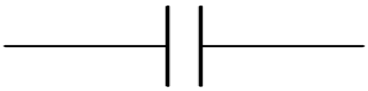
f) Compare two winding transformer with auto transformer by four points

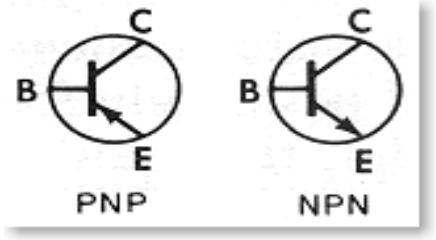
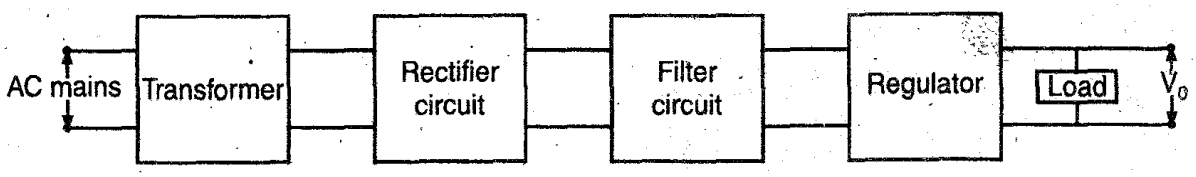
Ans: **(Any four points expected: Each point 1 Mark)**

Sr no.	Points	Autotransformer	Two winding transformer
1.	**Symbol**		
2.	**Number of windings**	It has one winding	It has two windings
3.	**Copper saving**	Copper saving takes more as compared to two winding	Copper saving is less
4.	**Size**	Size is small	Size is large
5	**cost**	Cost is low	Cost is high
6	**Losses in winding**	Less losses takes place	More losses takes place
7.	**Efficiency**	Efficiency is high	Efficiency is low
8.	**Regulation**	Regulation is better	Regulation is poor
9.	**Electrical isolation**	There is no electrical isolation	Electrical isolation is present in between primary and secondary winding
10.	**Movable contact**	Movable contact is present	Movable contact is not present
11.	**Application**	Variac, starting of ac motors, dimmerstat.	Mains transformer, power supply, welding, isolation transformer

---------- **(END PART-I)** ----------

SECTION — II

Q.4	Attempt. any NINE of the following: 18 Marks
a)	**Draw the symbol of capacitor. State any two applications of capacitor**
Ans:	**The symbol of capacitor:** **(1 Mark for symbol & 1 Mark for any 2 applications)**  **Applications of Capacitor** 1. Used as coupling & Bypass capacitor in amplifiers 2. Used in Filters circuit. 3. Oscillators , 4. Multivibrators and 5. lead-lag networks. 6. In different electronics fields/circuits such as linear integrated circuits, oscillators, etc.
b)	**Define intrinsic & extrinsic semiconductor**
Ans:	**Intrinsic semiconductor-** **(1 Mark for definition)** The semiconductor which is in purest form like Si, Ge (without trivalent or pentavalent impurities/ doping) is called "Intrinsic semiconductor." **Extrinsic semiconductor-** **(1 Mark for definition)** The semiconductor which is having doping of trivalent materials (Boron , Aluminium) or pentavalent materials (Phosphorus , Arsenic) is called "Extrinsic semiconductor."
c)	**Which charge carriers are majority & minority carriers in P-type & N-type semiconductor?**
Ans:	**P-type** - majority – Holes minority –Electrons **(1 Mark)** **N-type** - majority -- Electrons minority –Holes **(1 Mark)**
d)	**State any two applications of SCR.**
Ans:	**Applications of SCR:** (**2 Marks for any 2 applications)** 1) Used in phase controlled rectifiers 2) In choppers & inverters 3) For speed control of AC & DC motor 4) In cycloconverters& Stabilizes. 5) in SMPS & UPS

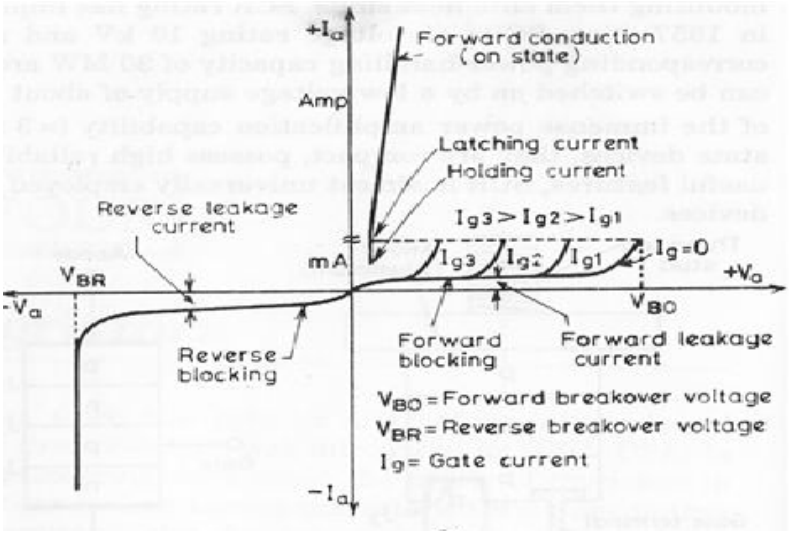
e)	**Draw the symbol of NPN & PNP transistor. Label its terminals.**
Ans:	**Symbol of NPN & PNP transistor:** **(1 Mark for each symbol)** 
f)	**What is amplifier? State the types of power amplifier**
Ans:	**Amplifier :** **(1 Mark)** An **amplifier** is an electronic device that increases strength of the voltage, current, or power of a signal. **Types of Power Amplifier :** **(Any Two expected:1/2 Mark each)** 1. Class A Power Amplifier, 2. Class B Power Amplifier, 3. Class AB Power Amplifier , 4. Class C Power Amplifier, 5. Push pull Power Amplifier
g)	**Draw the block diagram of regulated power supply**
Ans:	**Basic block diagram of a regulated power supply :** **(2 Mark)**  **OR any other equivalent diagram**
h)	**Enlist the different types of filters used in regulated power supply**
Ans:	**Types of filters:** **(1/2 Mark for each)** i) Shunt capacitor filter ii) Series inductor filter iii) LC Filter iv) CLC or π filter
i)	**State the need of voltage regulators**
Ans:	**Reason for the need of voltage regulators:** **(2 Marks)** In many electronic circuits, equipment's, systems needs constant dc supply for their proper functioning. So it is necessary to convert AC to regulated DC.

j)	**Draw the logic symbol & truth table of NAND gate**
Ans:	**Symbol of SCR and TRIAC:** **(1 Mark for Symbol & 1 Mark for Truth table)**

A	B	Out
0	0	1
0	1	1
1	0	1
1	1	0

k)	**What is negative & positive logic?**
Ans:	**Positive Logic**: **(1 Mark)** With reference to positive logic, logical 1 state is the most positive logic or voltage level and logic 0 states is the most negative logic or voltage level. In other words, active high level is 1 and active low level is 0. **Negative Logic**: **(1 Mark)** With reference to negative logic, logic 0 states is the most positive logic or voltage level and logic 1 state is the most negative logic or voltage level. In other words, active high level is 0 and active low level is 1.
l)	**State De-morgans theorem**
Ans:	**De-morgans theorem:** **(2 Mark)** $\overline{A \cdot B} = \overline{A} + \overline{B}$ DeMorgan's Theorem 1 $\overline{A + B} = \overline{A} \cdot \overline{B}$ DeMorgan's Theorem 2

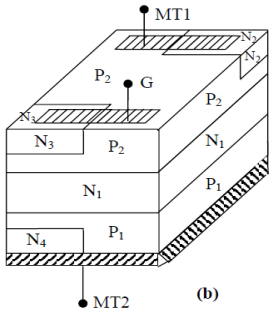
Q.5	**Attempt any FOUR of the following:** **16 Marks**
a)	**Draw the VI characteristics of SCR. Explain different modes of operation of SCR**
Ans:	**Construction of PN junction diode: -** **(2 Marks for Characteristics & 2 Marks for Operation)**



Modes of operation :

1) **Forward blocking**: When Anode is kept positive w.r.t. Cathode with no gate signal of Silicon Control Rectifier SCR J1 and J3 become forward bias while the junction J2 become reverse biased & SCR operates in **forward blocking mode.**
2) **Forward conducting:** When Anode is kept positive w.r.t. Cathode & gate current is supplied to Silicon Control Rectifier SCR J1 and J3 already forward biased & gate signal injects electrons & holes into p region & breakdown of J2 takes place & start conduction. the SCR turns ON. Higher gate current lower voltage required to turn on scr.
3) **Reverse blocking: When** Cathode is kept positive w.r.t. Anode of Silicon Control Rectifier SCR J1 and J3 become reverse bias while the junction J2 become forward biased & SCR operates in **reverse blocking mode.**

b)	**Describe the working principle of TRIAC with the help of neat sketch. Also state its two applications.**
Ans:	**Neat Sketch of TRIAC**



Working Principal of Traic:

Since a Triac is a bidirectional device and can have its terminals at various combinations of positive and negative voltages, there are four possible electrode potential combinations as given below

1. MT_2 positive with respect to MT_1, G positive with respect to MT_1
2. MT_2 positive with respect to MT_1, G negative with respect to MT_1
3. MT_2 negative with respect to MT_1, G negative with respect to MT_1
4. MT_2 negative with respect to MT_1, G positive with respect to MT_1

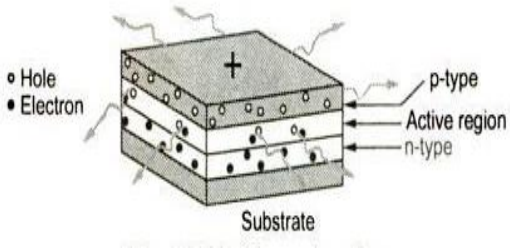
The triggering sensitivity is highest with the combinations 1 and 3 and are generally used. However, for bidirectional control and uniforms gate trigger mode sometimes trigger modes 2 and 3 are used. Trigger mode 4 is usually avoided.

In trigger mode-1 the gate current flows mainly through the P_2N_2 junction like an ordinary thyristor. When the gate current has injected sufficient charge into P_2 layer the triac starts conducting through the $P_1N_1P_2N_2$ layers like an ordinary thyristor.

In the trigger mode-3 the gate current I_g forward biases the P_2P_3 junction and a large number of electrons are introduced in the P_2 region by N_3. Finally the structure $P_2N_1P_1N_4$ turns on completely.

c) Describe the working principle of LED with the help of neat sketch. List its two applications.

Ans: **Construction of LED :-** **(2 Marks)**



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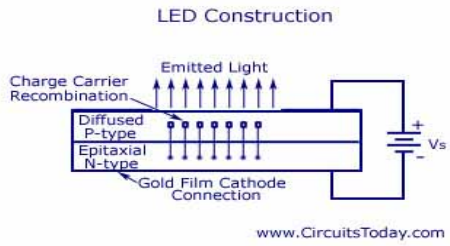


One of the methods used for the LED construction is to deposit three semiconductor layers on the substrate. In between p-type and n-type, there exists an active region.

Working of LED :- (LED- Light Emitting Diode) **(1 Mark)**

- When it is forward bias, it emits visible light. The electrons are in the higher conduction band on the N-side, where holes are are in the lower valence band on p- side.

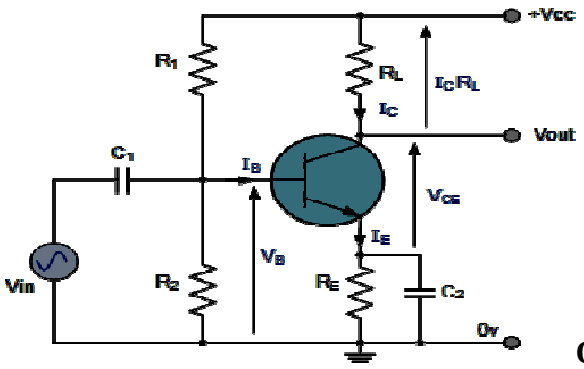
- When forward biased electrons recombine with the holes. During recombination energy is emitted in form of light.
- G_aA_s, G_aP, G_aA_sP are used to get visible light.(G_aA_S- Infrared radiation, G_aP- Red or green, G_aA_sP- Red or yellow
- Colors of the emitted light depend on the type of material used.

Applications : (Any Two expected) **(1 Mark)**

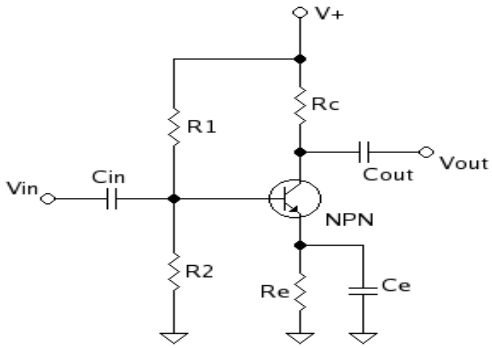
7 segment display, bar graph display, as a indicators, monitoring & control display, 14 segment display.

d) Explain the working of single stage CE amplifier with the help of neat circuit diagram.

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



OR



or equivalent fig

Working :

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

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

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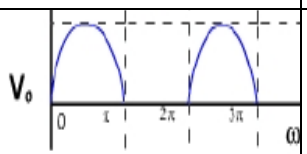
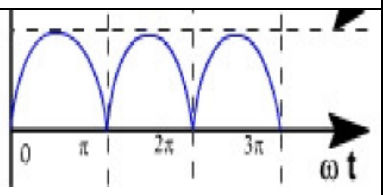
WORKING :-

- 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.
- Cin= Input coupling capacitor
- Cout=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 belowI_{BQ}.
3. Hence Ic =βI_B varies above and below ICQ. Variation in Ic is large.
4. Therefore voltage across Rc varies. VRC = Ic xRc.
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.

e) Compare Half wave & Full wave Rectifier with respect to number of diodes used, efficiency, ripple factor, & output waveform.

Ans: **(1 Mark for each parameter)**

Parameter	**Half wave**	**Full wave**
Number of diodes used	**1**	**2 or 4**
efficiency	**40.6 %**	**81.2 %**
ripple factor	**1.21**	**0.48**
Output waveform		

f) **State & prove commutative & Associative law of Boolean algebra.**

Ans:

1. Commutative law :- **(1 Mark for any 1 statement&1 Mark for Truth Table)**

OR Operation - A + B = B + A

AND operation- A.B = B.A

Proof :

A	B	A+B	B+A		A	B	A.B	B.A
0	0	0	0		0	0	0	0
0	1	1	1		0	1	0	0
1	0	1	1		1	0	0	0
1	1	1	1		1	1	1	1

2. Associative law : **(1 Mark for any 1 Statement &1 Mark for Truth Table)**

OR operation - A+ (B+C) = (A+B) +C

AND operation - A. (B.C) = (A.B).C

A	B	C	A+(B+C)	(A+B)+C
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

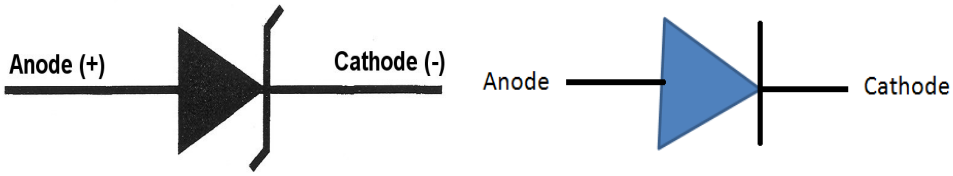
Q.6 **Attempt any FOUR of the following:** **16 Marks**

a) **Draw symbol of zener diode and PN diode. Draw V-I characteristics of zener diode.**

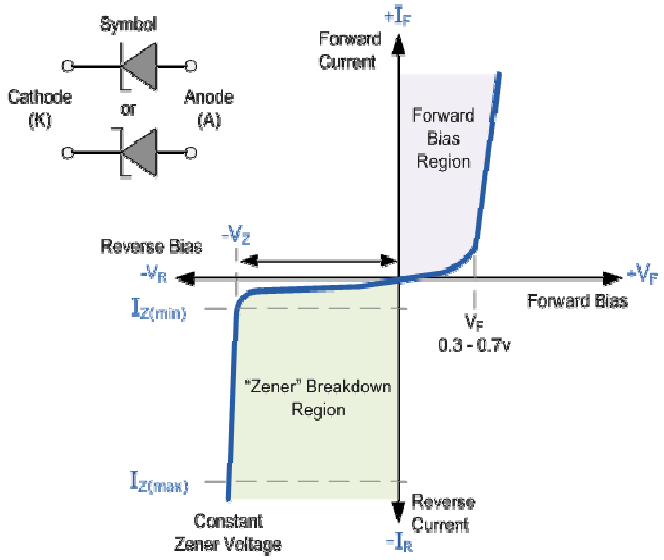
Ans:

i) Zener diode **ii) PN diode**

(Each Symbol : 1 Mark & Characteristics :2 Mark)

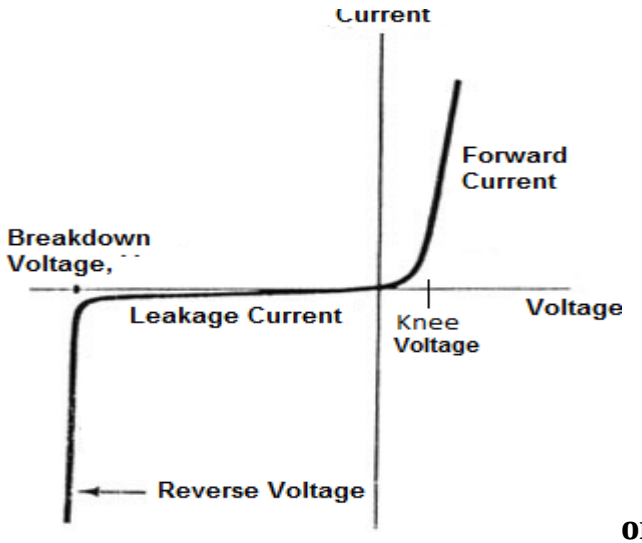


V-I characteristics of zener diode:



b) **Draw the forward and reverse V-I characteristics of diode. Define cut-in voltage or knee voltage of diode. State the value of knee voltage for silicon diode.**

Ans: **Forward and reverse V-I characteristics of diode:** **(2 Mark)**



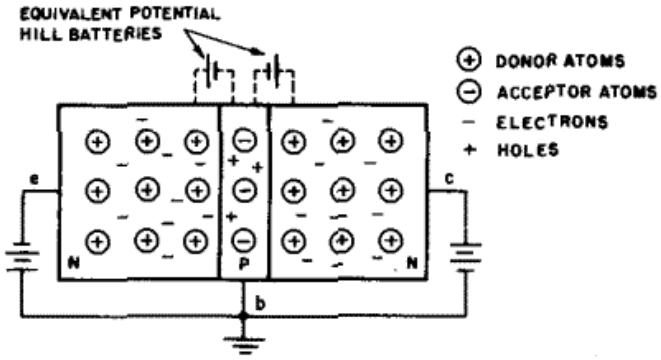
or equivalent Figure

i) Meaning of cut in voltage or Knee Voltage : **(1 Mark)**

The voltage at which the current through diode start increases &the diode starts conducting.

ii) Value of Knee Voltage For Silicon diode: – 0.7 V. **(1 Mark)**

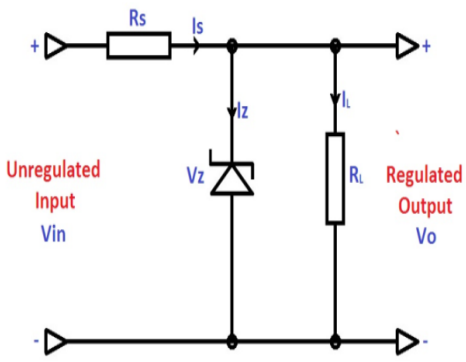
c)	**Describe the working of NPN transistor with the help of neat sketch**
Ans:	**Sketch of NPN transistor-** **(Figure: 2 Mark & Working : 2 Mark)**



Working operation of NPN transistor:

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

d)	**Describe the working of zener diode as a shunt regulator with the help of neat circuit diagram.**
Ans:	**Diagram of zener diode as voltage regulator:** **(2 Mark)**



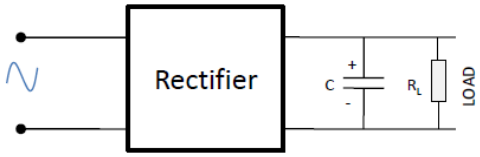
or equivalent figure

Working of zener diode as a shunt regulator: **(2 Mark)**

Zener Diodes are widely used as Shunt Voltage Regulators to regulate voltage across small loads. Zener Diodes have a sharp reverse breakdown voltage and breakdown voltage will be constant for a wide range of currents. Thus we will connect the zener diode parallel to the load such that the applied voltage will reverse bias it. Thus if the reverse bias voltage across the zener diode exceeds the knee voltage, the voltage across the load will be constant.

e) Describe the working of shunt capacitor filter with the help of neat sketch.

Ans: **Sketch of shunt capacitor filter: -** **(Figure :2 Mark, Working :2 Mark)**

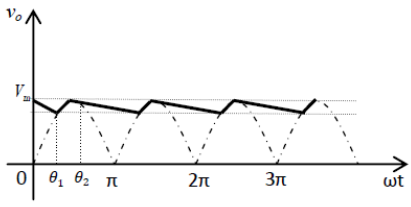


or equivalent figure

Working :

This type of filter consists of large value of capacitor connected across the load resistor RL as shown in figure. This capacitor offers a low reactance to the a.c. components and very high impedance to d.c. so that the a.c. components in the rectifier output find low reactance path through capacitor and only a small part flows through RL, producing small ripple at the output as shown in figure. Xc (=1/2πfC, the impedance of capacitor) should be smaller than RL. Because, current should pass through C and C should get charged. If C value is very small, Xc will be large and hence current flows through RL only and no filtering action takes place. The capacitor C gets charged when the diode (in the rectifier) is conducting and gets discharged (when the diode is not conducting) through RL.

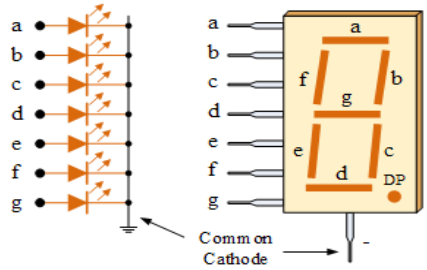
When the input voltage $v = Vmsin\omega t$ is greater than the capacitor voltage, C gets charged. When the input voltage is less than that of the capacitor voltage, C will discharge through RL. The stored energy in the capacitor maintains the load voltage at a high value for a long period. The diode conducts only for a short interval of high current. The waveforms are as shown in figure. Capacitor opposes sudden fluctuations in voltage across it. So the ripple voltage is minimized.



or equivalent figure

f)	**Explain types of LED display with neat sketches.**
Ans:	**1) Seven segment display:**

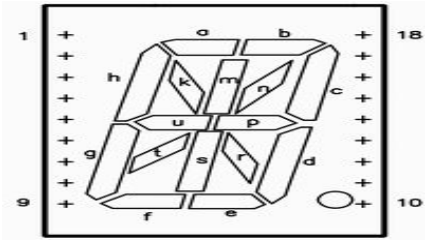
(Any One Method Expected: Figure : 2 Mark & Explanation:2 Mark)



or equivalent figure

The *7-segment display* consists of seven LEDs arranged in a rectangular fashion as shown. Each of the seven LEDs is called a segment because when illuminated the segment forms part of a numerical digit to be displayed. An additional 8th LED is sometimes used within the same package thus allowing the indication of a decimal point, (DP) when two or more 7-segment displays are connected together to display numbers greater than ten.

2) Alphanumeric display:

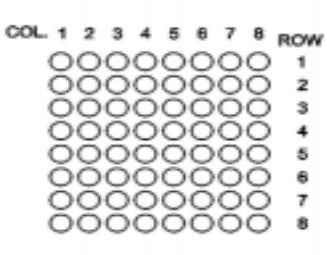


or equivalent figure

Alphanumeric display is designed to display alphanumeric characters such as letters, symbols and digits.

A fourteen segment or sixteen segment are available in market.

3) Dot matrix display:



or equivalent figure

They are available with 5 × 7, 16 × 8 or 8 × 8 etc. This display is designed to display letters, symbols, pictures and digits etc.

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