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)	**State Ohm's Law.**
Ans	**Ohms Law:** ---------- (**State-1 Mark & Equation-1 Mark)** The current flowing through a solid conductor is directly proportional to the difference of potential across the conductor. & inversely proportional to its resistance provided the temperature remains constant. **Equation:-** **i.e** $I \propto V \quad \therefore \frac{V}{I} = constant \ \therefore I = \frac{V}{R}$ $or \ \therefore V = I.R. \quad or \quad R = \frac{V}{I}$ **Where** R is constant called as resistance, V=voltage and I = Current
b)	**State principle of electromagnetic induction.**
Ans	**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. ----------**(1 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 $d\phi$ = Rate of Change of flux ----------**(1 Marks)**

c)	**What is necessity of starter.**
Ans	**Necessity of the starter:** **(2 Mark)** The current drawn by motor $I_a = \frac{V - E_b}{R_a}$, at start speed $N = 0$, $\therefore E_b \alpha$ N therefore back emf will be zero so $I_a = \frac{V}{R_a}$. 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 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 two applications of D.C. motors related to chemical plant.**
Ans	**Applications of DC shunt motor:** **(Any Two applications expected: 1 Markeach)** 1. Line shafts 2. Lathes 3. Vacuum cleaners 4. Pressure blowers 5. Reciprocating pumps 6. Wood working machines
e)	**Define voltage ratio and current ratio of 1-ph transformer.**
Ans	**i) Voltage Ratio:-** ----------**(1 Marks)** It is the ratio of secondary voltage to primary voltage. $Voltage\ ratio = \frac{V_1}{V_2}$ **OR Student may write** $Voltage\ ratio = \frac{V_2}{V_1}$ **ii) Current Ratio (I):-** ----------**(1 Marks)** It is the ratio of secondary number of turns to primary number of turns. $Current\ Ratio\ (I) = \frac{I_1}{I_2}$
f)	**State the necessity of fuse.**
Ans	**Necessity of Fuse:** **(Necessity of fuse- 2 Mark)** ➢ Fuse is a wire of short length or thin strip of material having low melting point ➢ It is protective device against over current, occurs due over load or short circuit. ➢ When some faults, such as short circuit occurs or when loads more than circuit capacity is connected in it, the current exceeds the limiting value, the fuse wire gets heated, melts and breaks the circuit.

g)	**What is the necessity of earthing.**
Ans:	**Necessity Earthing:** **(2 Mark)** ➢ Earthing provides protection to the electrical machinery due to leakage current. ➢ Earthing provides protection to Tall Building & structure against lightening stroke ➢ Earthing is protecting human from shocks.
h)	**Define transformation ratio of single phase transformer and write EMF equation.**
Ans:	**i) Transformation Ratio (k):- ----------(1 Marks)** It is the ratio of secondary number of turns to primary number of turns. OR It is the ratio of secondary voltage to primary voltage. **OR** It is the ratio of primary current to secondary current. **OR** $Transformation\ \ ratio\ (k) = \frac{N_2}{N_1}\ or = \frac{E_2}{E_1}\ or = \frac{V_2}{V_1}\ or = \frac{I_1}{I_2}$ **ii) EMF equation of Transformer:-** **(1 Marks)** **Let, N_1=** Number of turns in the primary **N_2=** Number of turns in the Secondary **Øm=** Maximum flux in core (wb)= BmxA **F=** Frequency $E_1 = 4.44\ f\ \phi m N_1$ **$E_1 = 4.44\ f\ BmAN_1$** Secondary winding: $E_2 = 4.44\ f\ \phi m N_2$ **$E_2 = 4.44\ f\ Bm\ A\ N_2$**
i)	**Define electrical power and energy.**
Ans:	**Power:** **(1 Mark)**

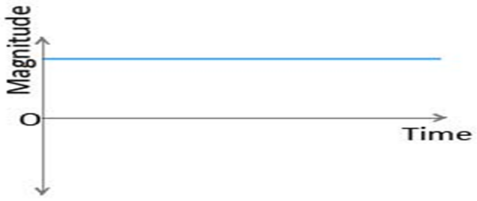
	The rate of doing work done is known as power. Its unit is watt **Energy:** **(1 Mark)** The total work done in the given time is known as energy. Its unit is KWH
j)	**wo resistance of 8 Ω and 4Ω are connected in series with parallel resistance of 12Ω to a battery of 60 volt. Calculate(i) Total effective resistance (ii) Total current**
Ans:	**Given Data:** R_1 =8 ohm, R_2 = 4 ohm in series R_3 = 12 ohm V = 60 V **i) Effective resistance:** R_1 =8 ohm, R_2 = 4 ohm in series $R_{T1} = R_1 + R_2 = 8+4= 12$ ohm R_{T1} &R_3**connected with parallel** $$R_T = \frac{R_{T1} * R_3}{R_{T1} + R_3} = \frac{12 * 12}{12 + 12} = \frac{144}{24} = 6\ \Omega$$ **R_T= 6 Ω ----------(1Mark)** **Current supplied to the circuit:** $$\text{curret I} = \frac{V}{R_T} = \frac{60}{6} = 6\ Amp$$ Current I =6 Amp---------- **(1 Mark)**
k)	**State the methods used for speed control dc shunt motor.**
Ans:	**Speed Control of D.C. Shunt motor :** **(Any one method expected-2Mark)** **1) Armature Voltage Control Method for DC Shunt Motor:** Speed control by this method involves two ways . ➢ Armature resistance control : ➢ Armature voltage control: **2) Flux (field) Control Method for DC Shunt Motor:-** 1. Field rheostat control of DC Shunt Motor:
l)	**Define A.C. and D.C. supply with their representation.**
Ans:	**(Each Definition 1/2 marks & representation1/2 marks)** **Alternating current (AC)** is an electric current which periodically reverses direction **Or** Alternating current describes the flow of charge that changes direction periodically

Alternating Current

or **equivalent figure**

Direct current (DC) which is electricity flowing in a constant direction,

Orpossessing a voltage with constant polarity.



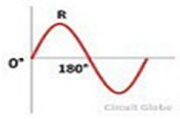
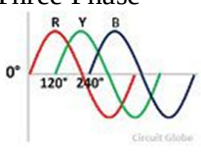
Direct Current

or **equivalent figure**

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

a) **Write four point of comparison between single phase supply system and three phase supply system.**

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

Parameter	Single Phase	Three Phase
Number of wires.	Single Phase Require two wires for completing the circuit.	Three Phase Requires three/four wires for completing the circuit.
Voltage	Single Phase normally operate at 230V	Three Phase operate at 415V
Naming	Single phase supply wires are indicated as L and N	Three phase supply wires are indicated as R-Y-B-N
Power	Single phase supply delivers oscillating power	Three phase supply delivers constant power
Use	It is preferred for distribution purpose and domestic supply	It is always preferred for transmission
Copper	It requires thick copper for transmitting same power	It requires smaller copper diameter to transmit same power
Wave Shape	Single Phase 	Three Phase 

b)	List the different parts of DC machine. State function of any two parts.
Ans:	**(Any Four parts of name expected -1/2 Mark each , & Function of any Two part -1 Mark each part)**

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:
6) Brush:
7) Cooling Fan:
8) End covers
9) Field winding

Function : (Any Two part expected)

1) 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 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:

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 to form rotor winding.

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

6) Brush:
Brushes are used to pass the current to the commutator from the external circuit.

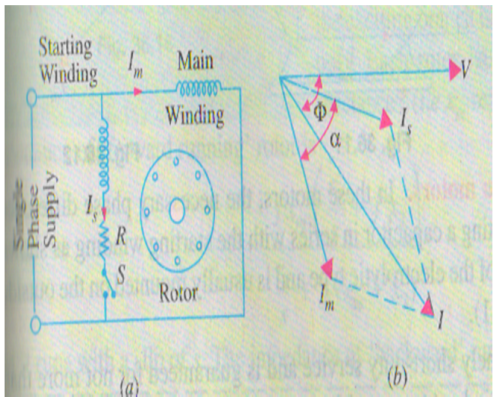
7) Cooling Fan:
A fan is fitted to the shaft for cooling purposes.

8) 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.

c) Describe with a circuit diagram, the operation of resistance split phase run single phase induction motor.

Ans: **(Diagram: 2 Mark & Operation: 2 Mark)**

Circuit diagram of resistance split phase run single phase induction motor:



or equivalent figure

Operation of resistance split phase run 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**.**
- **As one phase is highly resistive and other inductive, there is a phase shift of nearly 40^0 in current of both winding and this creates rotating magnetic field and causes the motor to rotate.**
- A centrifugal switch S is connected in series with the starting winding and is located

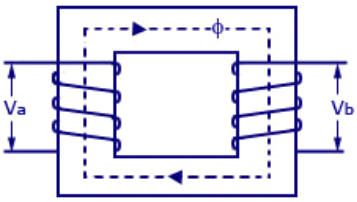
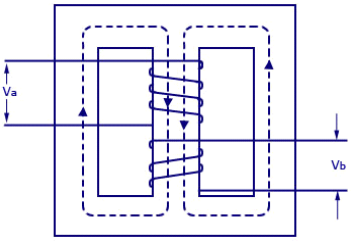
inside the motor.

- 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.

d) Compare core type and shell type transformer. (any four points)

Ans:

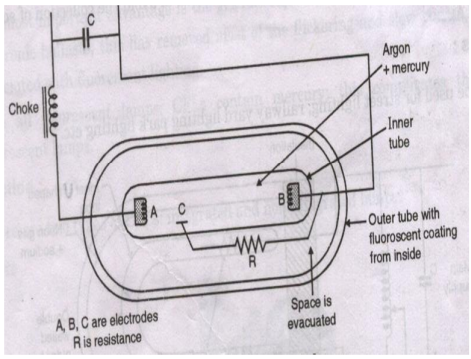
(Any Four points expected each:1 Marks)

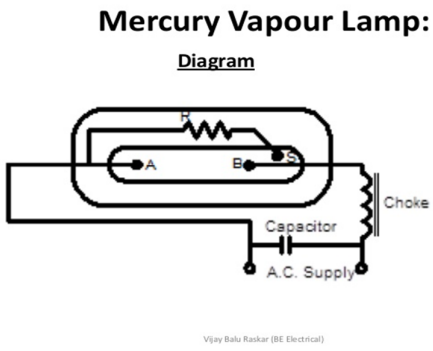
S.No	Core Type Transformer	Shell Type Transformer
1.		
2.	The Winding surround the core	The core surround the windings
3.	Magnetic Flux has only one continuous path	Magnetic Flux is distributed into 2 paths
4.	Suitable for high voltage & less output	Suitable for less voltage & high output
5.	Easy for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

e) Describe the operation of mercury vapour lamp with neat connection diagram.

Ans:

- **Figure Mercury Vapour discharge lamp :-(Figure: 2 Mark, Working : 2 Mark)**





or

equivalent figure

Construction:- (Instead of figure Construction may be accepted)

- MV lamps consist of an arc tube (inner) enclosed by an outer tube.
- Vacuum is created between the inner & outer glass tube to prevent heat loss/ the space between the two is filled with nitrogen.
- The inner bulb contains neon or argon gas with certain quantity of mercury.
- Arc tube also contains two electrodes and starting electrode.
- It requires a ballast to give high voltage at staringto produce the arc.
- The capacitor is used to improve the power factor.

Operation:

- When the lamp is turned on, a high voltage at staring is applied,lamp start with a small arc between the starting electrode and the main electrode,
- An arc which discharges through argon gas (starting gas)and vaporizesmercury vapor
- The energized mercury vapor atoms emit light.
- After 5 minutes, the lamp gives full light.
- It gives greenish blue color light

f) State the meaning of the terms MCCB and ELCB and give their applications.

Ans:

Meaning of MCCB:(Each Meaning : 1 Mark &Any one Application : 1 Marks)

- Moulded Case Circuit Breakers are electromechanical devices which protect a circuit from Overcurrent and Short Circuit.

Application of MCCB : (Any One application expected)

1. Main electric feeder protection
2. Generator protection
3. Motor protection
4. Home appliances protection
5. power system protection
6. Welding transformer protection
7. Capacitor bank protection

Meaning 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 and avoid the person getting shock.

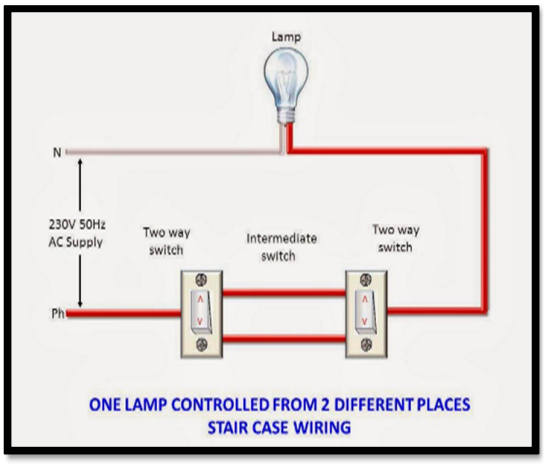
Application of ELCB:

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

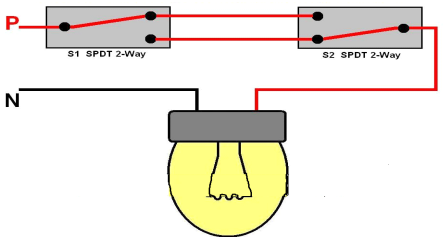
Q.3 Attempt any FOUR of the following: 16 Marks

a) Draw the wiring diagram of staircase wiring and explain its working.

Ans: **wiring diagram of staircase wiring:** **(Figure: 2 Mark)**



OR



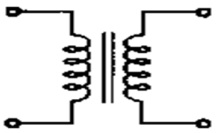
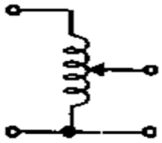
OR Equivalent figure

Working : **(Figure: 2 Mark)**

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.

b) Compare two winding transformer with auto transformer by four points.

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

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

c) For 12 KVA, 440 V/200V, 50 Hz 1-Ph transformer find,(i) Primary current (ii) Secondary current (iii) Turns ratio and (iv) No. of turns on primary side

Ans:

i) Primary current (I_1):

$$I_1 = \frac{KVA}{V_1}$$ ---------- **(1/2 Mark)**

$$I_1 = \frac{12 \times 10^3}{440}$$

$$I_1 = 27.2727\ Amp$$

---------- **(1/2 Marks)**

ii) Secondary current (I_2):

$$I_2 = \frac{KVA}{V_2}$$ ---------- (1/2 Mark)

$$I_2 = \frac{12 \times 10^3}{200}$$

$$I_2 = 60\ Amp$$ ---------- (1/2 Marks)

iii) 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)

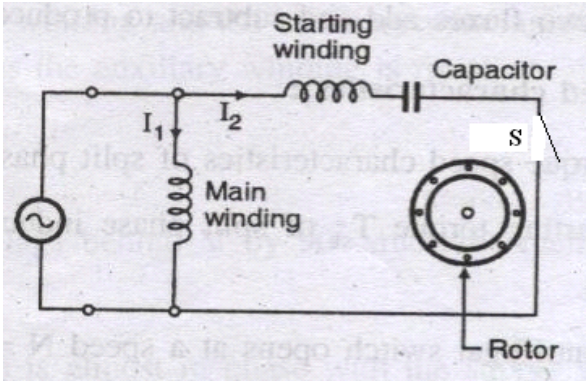
iv) No. of turns on primary $K = \frac{N_2}{N_1} = 0.4545$

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

d) Describe with a circuit diagram, the operation of capacitor start induction run single phase induction motor,

Ans: (Diagram-2 Marks &Operation-2 Marks)

Capacitor-start-Induction run 1-Ph Induction Motor:-



or Equivalent fig

Working Principle:

In these motors starting winding (Ws) has a capacitor in series with it. So phase difference in two winding currents is produced by inductive reactance of main winding (Wm) and capacitive reactance of starting winding circuit.

The rotor rotates due to rotating magnetic field. The starting torque produced by two windings is very high.

e) Compare squirrel cage and slip ring type three phase induction motors. (any four points)

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

S.No	3-phase squirrel cage I.M	Slip ring 3-Ph I.M
1	Rotor is in the form of bars	Rotor is in the form of 3-ph winding
2	No slip-ring and brushes	Slip-ring and brushes are present
3	External resistance cannot be connected in the rotor circuit	External resistance can be connected in the rotor circuit
4	Small or moderate starting torque	High Starting torque
5	Starting torque is of fixed	Starting torque can be adjust
6	Simple construction	Completed construction
7	High efficiency	Low efficiency
8	Less cost	More cost
9	Less maintenance	Frequent maintenance due to slip-ring and brushes.
10	Starting power factor is poor	Starting power factor is adjustable & large
11	Size is compact for same HP	Relatively size is larger
12	Speed control by stator control method only	Speed can be control by stator & rotor control method

f) State the function of no volt coil and overload coil in case of DC shunt motor starter.

Ans: **i) Function of no volt coil in case of DC shunt motor starter:** **(2 Mark)**

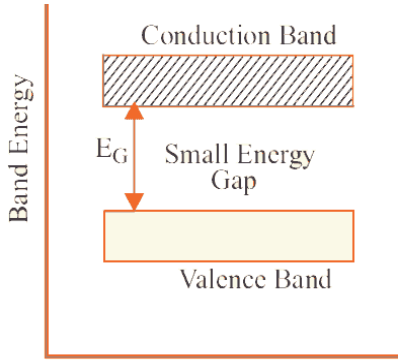
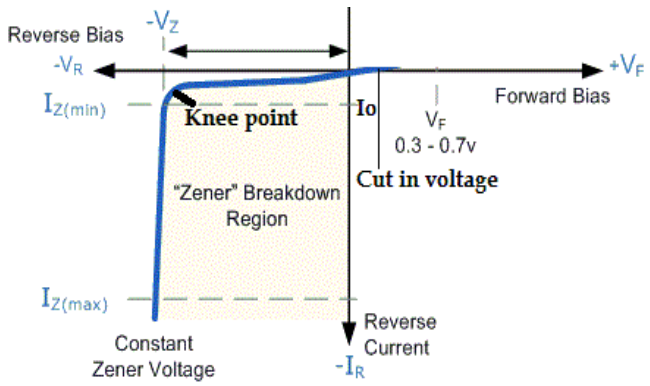
Whenever voltages is low or the supply is switched off then no-volt coil will be operate and motor will become off automatically or it will never on at low voltage.

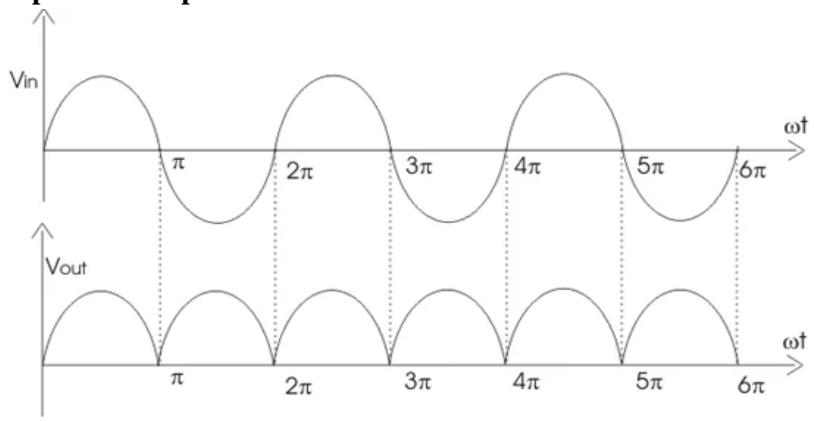
ii) Function of overload coil in case of DC shunt motor starter: **(2 Mark)**

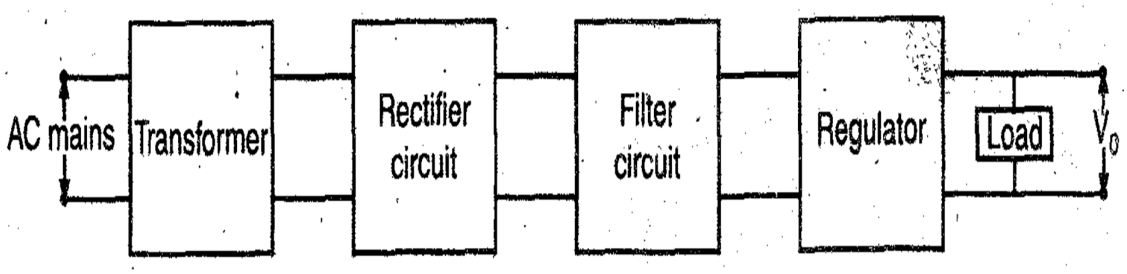
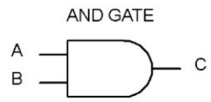
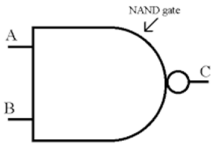
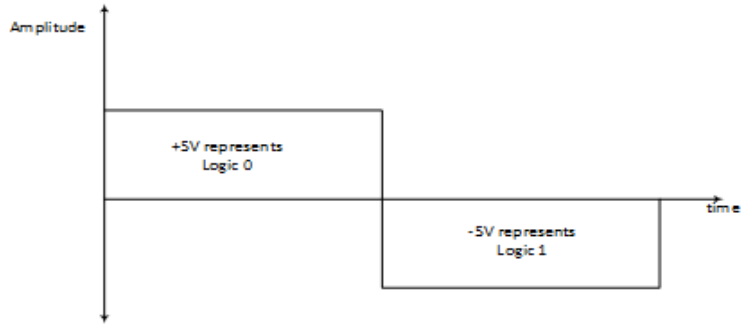
Whenever motor is overloaded due to any reason due to this overload coil motor will become off automatically.

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

SECTION — II

Q.4	Attempt any NINE of the following: 18 Marks
a)	**Define semiconductor. Draw the energy band diagram for semiconductor.**
Ans:	**Semiconductor** **(1-Mark)** The materials which have conductivity in between insulator & conductor and which have four electrons in its outermost orbit are called as semiconductor. **OR** In Semiconductors the gap between Valence band and Conduction band is very small i.e. 1.1 eV. So the conductivity is between conductors and insulator. **Energy band diagram :** **(1-Mark)** 
b)	**List the minority and majority charge carriers in N-type semiconductor.**
Ans:	**Minority charge carriers :** Holes **(1-Mark)** **Majority charge carriers :** Electrons **(1-Mark)**
c)	**Draw the V-I characteristic of zener diode in reverse bias.**
Ans:	**V-I characteristic of zener diode in reverse bias :** **(2-Marks)** 

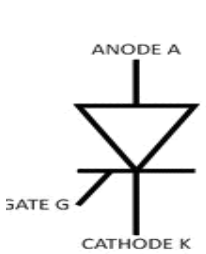
d)	**List one application of - (i) LED and (ii) Zener diode**
Ans:	**Application of LED :**7 segment display, bar graph display, as a indicators, monitoring & control display, 14 segment display. **(Any one 1-Mark)** **Application of Zener diode :** Used as regulator in power supplies. **(1-Mark)**
e)	**What is the meaning of BJT?**
Ans:	**Meaning of BJT:** **(2 Marks)** A bipolar junction transistor (bipolar transistor or BJT) is a type of transistor that uses both electron and hole charge carriers for conduction. A bipolar junction transistor is a type of semiconductor that is formed by joining two types of semiconductor junctions. (PNP or NPN).
f)	**What is power amplifier? State the types of power amplifier.**
Ans:	**Power amplifier**: **(1-Mark)** A Power amplifier is an electronic device that can increase the power of a signal. **Types of power amplifier:** **(Any Two Types expected ; 1-Mark)** i) Class A power amplifier ii) Class B power amplifier iii) Class AB power amplifier iv) Push pull power amplifier.
g)	**What is the meaning of regulator in voltage regulator?**
Ans:	**Voltage regulator:** **(2 Marks)** A voltage regulator is an Electronic circuit which gives a fixed output voltage that remains constant regardless of changes to its input voltage or load conditions
h)	**Draw the input and output waveform of full wave rectifier.**
Ans:	**Input and output waveform of full wave rectifier :** **(2-Marks)** 

i)	**Draw the block diagram of regulated power supply.**
Ans:	**Block diagram of regulated power supply:** **(2-Marks)** 
j)	**Draw the symbol of (i) AND gate and (ii) NAND gate**
Ans:	**Symbol of AND and NAND gates** : **(Each symbol - 1 mark)** 1) AND Gate  2) NAND Gate: 
k)	**Write DeMorgan's first theorem.**
Ans:	**DeMorgan's first theorem :** **(2-Marks)** $\overline{AB} = \overline{A} + \overline{B}$
l)	**What is the meaning of negative logic?**
Ans:	**Negative logic :** **(2-Marks)** In Negative logic representation Bit 1 represents logic low and Bit 0 represents logic high as shown in Figure. **OR** In negative logic inputs and outputs are called active low. 

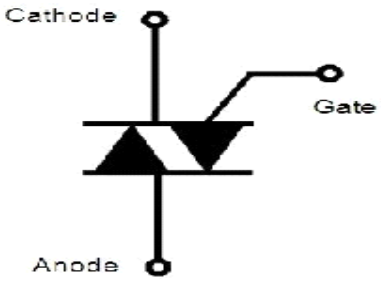
Q.5	Attempt any Four of the following: 16 Marks
a)	Draw the symbol of SCR and Triac. Describe the working of SCR.

Ans:

Symbol of SCR and Triac : **(2-Marks)**

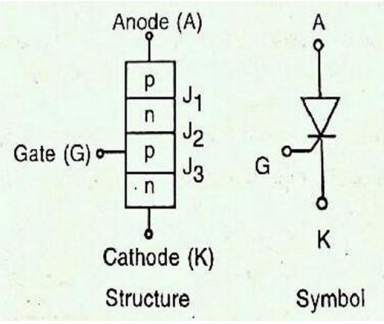


SCR



TRIAC

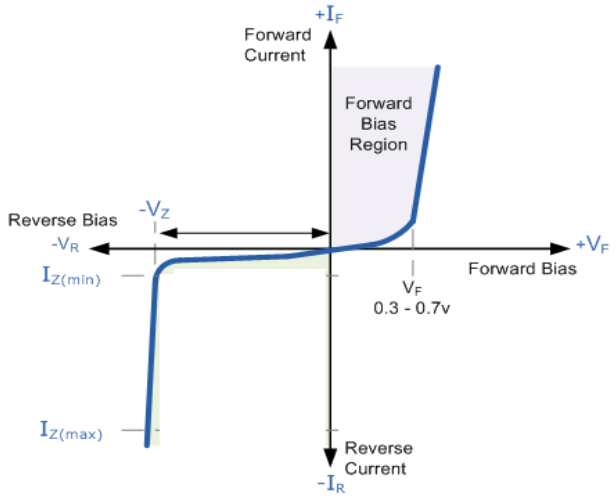
Working of SCR. - **(2 Marks)**



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.

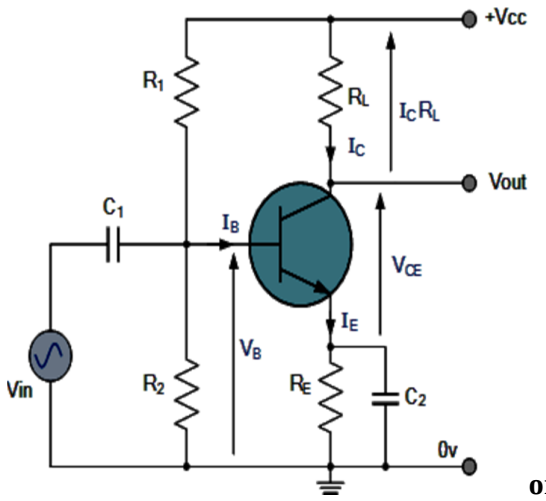
Without breakdown of junction J2, S.C.R. can be made ON by applying +vevoltage to gate w.r.t. cathode. Due to this, junction J3 is forward biased and conducts and gate current flows. Free movement of carriers (holes and electrons) across the junction J3 results in injection of holes into n-region and 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.

b)	**Define extrinsic semiconductor. List it's types and materials used for doping.**
Ans:	**Definition of extrinsic semiconductor:**Those semiconductors in which some impurity atoms are added are known as extrinsic semiconductors. **(1-Mark)** OR An extrinsic semiconductor is a semiconductor doped by a specific impurity which is able to deeply modify its electrical properties, making it suitable for electronic applications **Types of extrinsic semiconductor :** N type and P type **(1-Mark)** **Materials used for doping :** 1) For N type : Phosphorous (P), Arsenic (As), Antimony (Sb) **(1-Mark)** 2) For P type : Boron (B) ,Gallium (Ga) **(1-Mark)**
c)	**Write two applications of (i) LED (ii) P.N junction diode and (iii) Zener diode. Draw the characteristics of PN junction diode.**
Ans:	**Applications :** **(Any two expected: 1 Mark)** **(i) LED :**7 segment display, bar graph display, as a indiacators, monitoring & control display, 14 segment display. **(ii) P.N junction diode :**Rectifier, clippers etc. **(iii) Zenner diode :** Voltage Regulator in power supply, Reference element. **Characteristics of PN junction diode :** **(1-Mark)** 

d) **(i) Draw the circuit diagram of single stage CE amplifier.**
ii) Draw its Input and Output waveforms. (iii) Write the use of Ce or CE.

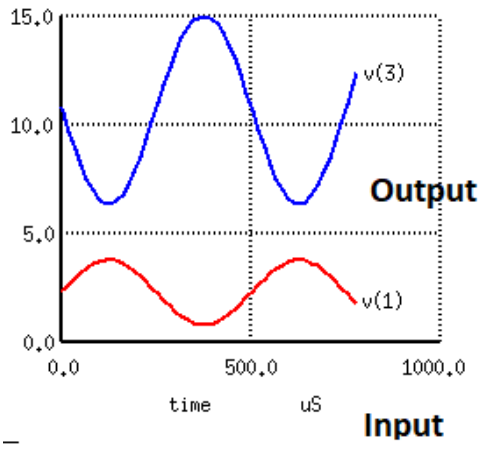
Ans:

(i) Circuit diagram of single stage CE amplifier: **(2 Mark)**



or equivalent fig

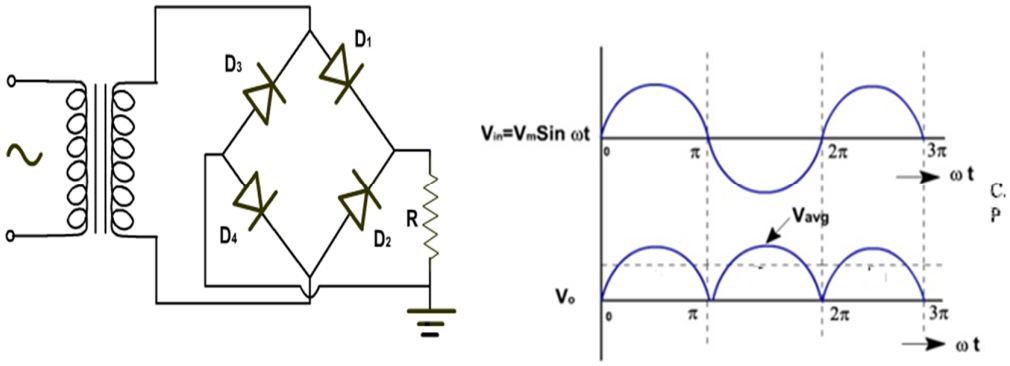
(ii) Input and Output waveforms: **(1 Mark)**



(iii) Use of Ce or CE : **(1 Mark)**

The bypass capacitor is a capacitor that shorts AC signals to the ground in a way that any AC noise that present on a DC signal is removed producing a pure DC signal. A bypass capacitor basically bypasses AC noise that may be on a DC signal.

e)	**Draw the circuit diagram of bridge type full wave rectifier. List the advantages of this circuit over center-tapped type full wave rectifier.**
Ans:	**Diagram of Bridge rectifier:** **(Diagram: 2 Mark)**



Advantages of this circuit over center-tapped type full wave rectifier : **(2 Mark)**

1) Centre tap transformer is not required.

2) PIV = Vm which is less as compared to center-tapped type full wave rectifier

3) TUF is more as compared to center-tapped type full wave rectifier

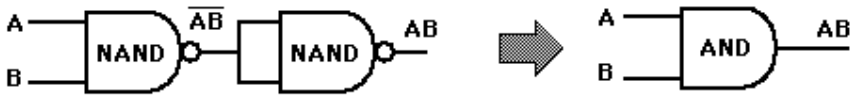
f)	**(i) Draw the symbol of Ex-OR gate. Write its truth table and logic expression.** **(ii) Draw the AND gate logic using NAND gates.**
Ans:	**(i) Symbol of Ex-OR gate** **(3 Marks)**

Exclusive-OR gate

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

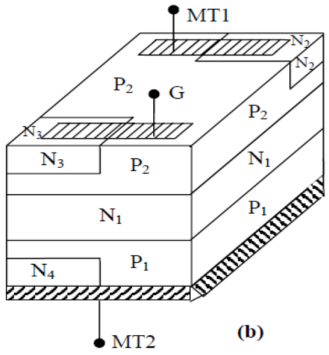
$$\text{Output} = A \oplus B$$
$$= \bar{A}B + A\bar{B}$$

(ii) AND gate logic using NAND gates : **(1 Mark)**



Q.6	**Attempt any Four of the following:** **16 Marks**
a)	**(i) Describe the working of Triac with neat construction diagram.** **(ii) List one application of 1) SCR and 2) Triac**

Ans: **(i) Diagram of TRIAC :** **(1 Mark)**



Working principle of TRIAC : **(2 Mark)**

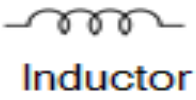
Since a Triac is a bidirectional device and can have its terminals at various combinations of positive and negative voltages, there are four possible electrode potential combinations as given below

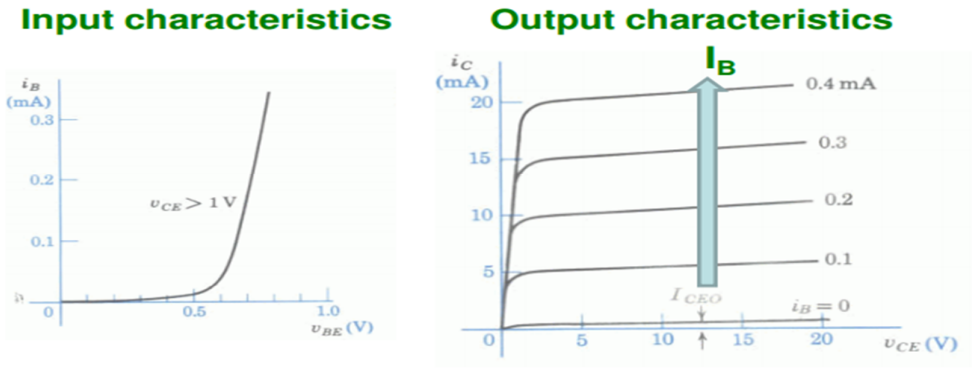
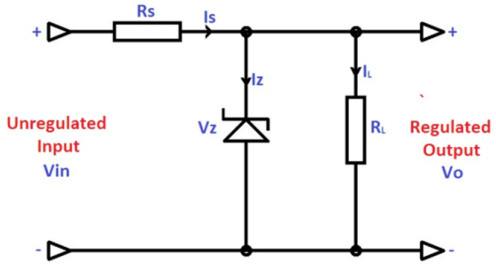
1. MT_2 positive with respect to MT_1, G positive with respect to MT_1
2. MT_2 positive with respect to MT_1, G negative with respect to MT_1
3. MT_2 negative with respect to MT_1, G negative with respect to MT_1
4. MT_2 negative with respect to MT_1, G positive with respect to MT_1

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 $P_2 N_2$ junction like an ordinary thyristor. When the gate current has injected sufficient charge into P_2 layer the triac starts conducting through the $P_1 N_1 P_2 N_2$ layers like an ordinary thyristor.

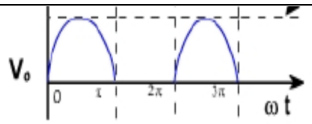
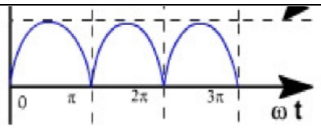
In the trigger mode-3 the gate current I_g forward biases the $P_2 P_3$ junction and a large number of electrons are introduced in the P_2 region by N_3. Finally the structure $P_2 N_1 P_1 N_4$ turns on completely.

	(ii) Application of following List: **1) Applications of S.C.R.: -** **(Any one 1/2 Mark)** 1.Chopper 2.Inverter 3.Drives, etc. **2) Applications of TRIAC : -** **(Any one 1/2 Mark)** 1) It is used as light dimmer. 2) It is used as fans speed regulators. 3) It is used in UPS/SMPS. 4) It is used in Inverters. 5) In AC flasher. 6) In Induction heating.
b)	**Draw the symbols of inductor. Define inductor and capacitor write one application of inductor and capacitor.**
Ans:	**Symbol of inductor:** **(1-Mark)**  Inductor **Definition of Inductor :**An inductor is a passive electronic component that stores energy in the form of a magnetic field. **(1-Mark)** **Definition of Capacitor :** A capacitor is a passive electronic component that stores energy in the form of an electrostatic field **(1-Mark)** **Applications of inductor** **(Any one 1/2-Mark)** 1) Filters 2) Choke uses in tube light **Applications of Capacitor** **(Any one 1/2-Mark)** • Used as coupling & Bypass capacitor in amplifiers • Used in Filters circuit. • Oscillators

c)	**Draw the characteristics of transistor in CE mode.**
Ans:	**Characteristics of transistor in CE mode:** **(4 Marks)** 
d)	**(i) Draw the circuit diagram of zener shunt regulator and describe its working.** **(ii) What is the need of filter in power supply?**
Ans:	**(i) Diagram of zener diode as voltage regulator:** **(1 Mark)**  **Working:** **(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. **(ii) Need of filter:** **(1 Mark)** To remove unwanted frequency components from the signal using different components such as Inductor, Capacitor etc.

e) Compare half wave and full wave rectifier.

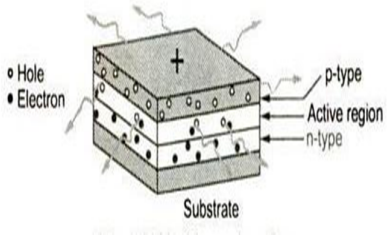
Ans: **(Any four points 4 Marks)**

S.No.	Parameter	Half wave	Full wave
1	**Definition**	The Rectifier that converts only one half Cycle of the input AC supply to DC is called Half Wave Rectifier.	The Rectifier that converts both Halves of the AC input supply Cycle into DC is Called Full Wave Rectifier.
2	**number of diodes used**	1	2 or 4
3	**efficiency**	40.6 %	81.2 %
4	**ripple factor**	1.21	0.48
5	**output waveform**		
6	**Peak Inverse Voltage (PIV)**	Vm	2Vm for center tap Vm for bridge
7	**DC Output Voltage**	V_m/π	$2V_m/\pi$
8	**Ripple frequency**	50 Hz	100 Hz

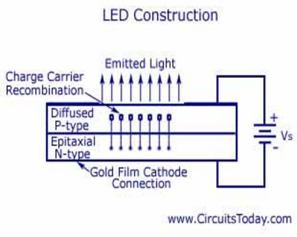
f) Explain the LED display or LCD display with neat diagram.

Ans: **(Diagram - 2 Marks, working principle- 2 Marks)**

Diagram light emitting diode :



or



Working of LED (LED- Light Emitting Diode) :

- When it is forward bias, it emits visible light. The electrons are in the higher conduction band on the N-side, where holes are are in the lower valence band on p- side.
- When forward biased electrons recombine with the holes. During recombination energy is emitted in form of light.
- G_aA_s, G_aP, G_aA_sP are used to get visible light.(G_aA_S- Infrared radiation, G_aP- Red or

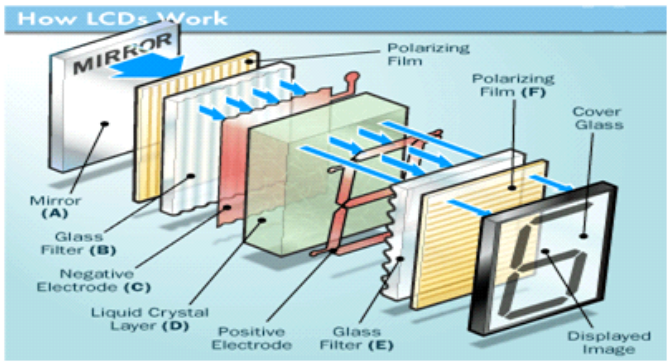
green, G_aA_sP- Red or yellow

- Colors of the emitted light depend on the type of material used.

OR

(Diagram - 2 Marks, working principle- 2 Marks)

Working principle of LCD display:



The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter.

Next comes to the second piece of glass with an electrode in the form of the rectangle on the bottom and, on top, another polarizing film. It must be considered that both the pieces are kept at right angles. When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank.

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