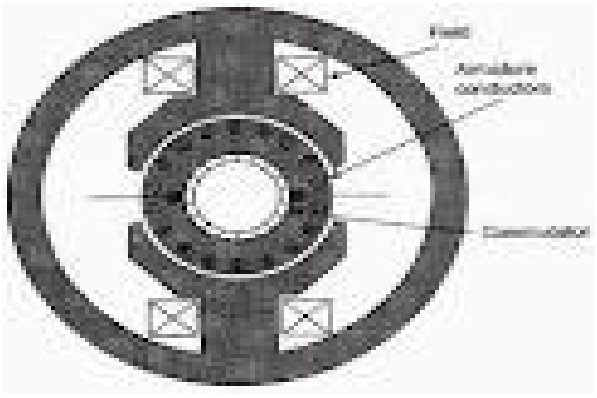
cImportant suggestions to examiners:

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 any two advantages of three phase system over single phase system**
Ans	**Advantages of 3-phase system over 1-phase system:** **(Any Two points each point 1 Mark)** 1. **More output:-** for the same size output of poly-phase machines is always higher than single phase machines. 2. **Smaller size:-**for producing same output the size of three phase machines is always smaller than that of single phase machines. 3. **More power is transmitted-** it is possible to transmit more power using a three phase system than single system. 4. **Smaller cross-sectional area of conductors-** if the same amount of power is transmitted then the cross-sectional area of the conductors used for three phase system is small as compared to that of single phase system. 5. Better power factor-power factor of three phase machines is better than that of single phase machines. 6. Three phase motors are self starting-three phase ac supply is capable of producing a rotating magnetic field when applied to stationary windings, the three phase ac motors are self starting. While single phase induction motor needs to use additional starter windings

	7. Horse power rating of three phase motors is greater than that of single phase motor. 8. Power delivered by a single phase system fluctuates whereas for three phase system power delivered to the load is the same at any instant.
b)	**State Ohm's law.**
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** $I \propto V \quad \therefore \frac{V}{I} = constant \ \therefore I = \frac{V}{R}$ $or \ \therefore V = I.R. \quad or \quad R = \frac{V}{I}$ **Where** R is constant called as resistance, V=voltage and I = Current
c)	**Define 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
d)	**State the 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 $N = 0, \ \therefore E_b = 0$ 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.

e)	**List the various parts of DC machine**
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: 6) Brush: 7) Cooling Fan: 8) End covers 9) Field winding
f)	**Write working principle of dc motor.**
Ans	**Working Principle of D.C Motor :-** **(02 Marks)**  **(or similar figure)** When current carrying conductor is placed in magnetic field force will be exerted on the conductor & motor start rotating it works on Flemings left hand rule.
g)	**What is ideal transformer? How it differs from practical transformer?**
	(Each point carrying 1/2 mark) 1. It is the transformer which does 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.

h)	**State need of earthing.**
Ans:	**Need of Earthing: (Any Two point are expected)** **(2 Mark)** 1. To provide an alternative path for the leakage current to flow towards earth. 2. To save human life from danger of electrical shock due to leakage current. 3. To protect high rise buildings structure against lightening stroke. 4. To provide safe path to dissipate lightning and short circuit currents. 5. To provide stable platform for operation of sensitive electronic equipments.
i)	**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
j)	**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) vii) MICC (Mineral insulated copper covered) wire. **OR** Following various types of wires and cables are used in domestic and industrial wiring: 1) V.I.R. (Vulcanized India Rubber) wire. 2) C.T.S. or T.R.S. (Cab Tyre Sheathed or Tough Rubber Sheathed) wire. 3) Weather proof wire. 4) L.C.(Lead Covered) wire. 5) MICC (Mineral insulated copper covered) wire. 6) PVC (Poly Vinyl Chloride) wire. 7) Flexible wire.
k)	**A transformer does not operate on a d.c. supply. State reason.**
Ans:	**Reason:** **(2 Marks)** Transformer works on faradays law of electromagnetic induction where alternating flux is required as working flux of transformer. When transformer operates on DC supply, stationary flux (Rate of change of flux

	linkages are zero) will be produced instead of alternating flux, so there is no induced emf in either primary or secondary winding.
l)	**Write two safety precautions to be taken while handling an electrical equipments.**
Ans:	**The Following are the precautions should be taken while working electricity:- (Any Two point expected : 1 Mark each)** 1. Avoid working on live parts. 2. Switch off the supply before starting the work. 3. Never touch a wire till you are sure that no currents are flowing. 4. Do not guess, whether electric current is flowing through a circuit by touching. 5. Insulate yourself on the insulating material like wood, plastic etc. before starting the work on live main. 6. Your hand & feet must be dry (not wet) while working on live main. 7. Rubber mats must be placed in front of electrical switch board/ panel. 8. Use hand gloves, Safety devices & proper insulated tools. 9. Ground all machine tools, body, and structure of equipments. 10. Earthing should be checked frequently. 11. Do not use aluminum ladders but use wooden ladders. 12. Do not operate the switches without knowledge. 13. Use proper insulated tools & safety devices. 14. When working on live equipment obey proper instruction. 15. Do not work on defective equipment. 16. Use safe clothing. 17. Use shoes with rubber soles to avoid shock. 18. Do not wear suspected Necklace, arm bands, finger ring, key chain, and watch with metal parts while working. 19. Do not use defective material. Do not work if there is improper illumination such as in sufficient light or unsuitable location producing glare or shadows. 20. Do not work if there is an unfavorable condition such as rain fall, fog or high wind. 21. Do not sacrifice safety rules for speed. 22. Do not allotted work to untrained person (worker) to handle electrical equipment. 23. Make habit to look out for danger notice, caution board, flags, and tags. 24. Warn others when they seen to be in danger near live conductors or apparatus. 25. Inspect all electrical equipment & devices to ensure there is no damage or exposed wires that may causes a fire or shock. 26. Avoid using electrical equipment near wet, damp areas. 27. Use approved discharge earth rod for before working.

	28. Never speak to any person working upon live mains. 29. Do not Do the work if you are not sure or knowledge of the condition of equipment/ machine. 30. Safety book/ Training should be given to all persons working in plants.
Q.2	**Attempt any FOUR of the following: 16 Marks**
a)	**State working principle of MCCB. State its applications.**
Ans:	**Working principle of MCCB: (Working Principle : 2 Mark & Application : 2 Marks)** ➢ Moulded Case Circuit Breakers are electromechanical devices which protect a circuit from Overcurrent and Short Circuit. ➢ There are two arrangement of operation of miniature circuit breaker. One due to thermal effect of over current and other due to electromagnetic effect of over current. ➢ The thermal operation of miniature circuit breaker is achieved with a bimetallic strip whenever continuous over current flows through MCCB, the bimetallic strip is heated and deflects by bending. ➢ This deflection of bimetallic strip releases mechanical latch. As this mechanical latch is attached with operating mechanism, it causes to open the MCCB. But during short circuit condition, sudden rising of current, causes electromechanical displacement of plunger associated with tripping coil or solenoid of MCCB. ➢ The plunger strikes the trip lever causing immediate release of latch mechanism consequently open the circuit breaker contacts. ➢ Their primary functions are to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. ➢ The overcurrent, in an electrical circuit, may result from short circuit, overload or faulty design. ➢ Moulded case circuit breakers generally have a Thermal element for overcurrent and Magnetic element for short circuit release which has to operate faster. **(Diagram not expected)** **Application : (Any Four 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

b) For 12 KVA, 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 =** $I_2 \equiv \frac{KVA \times 1000}{V2}$

$$I_2 \equiv \frac{12 \times 1000}{200}$$

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)**

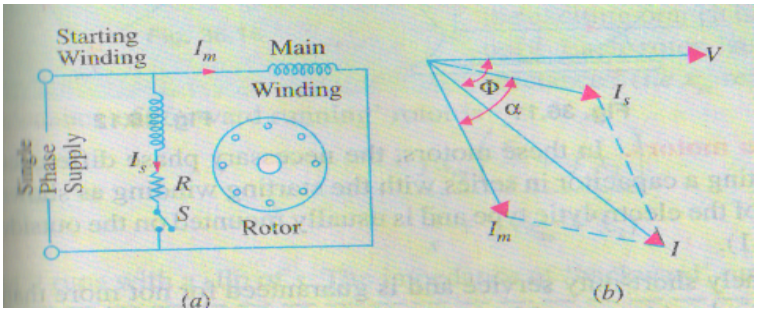
- **No. of turns on primary** $K = \frac{N_2}{N_1} = 0.4545$

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

c) With neat construction explain working of R-Split type of induction motor.

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

Circuit diagram of resistors split single phase induction motor:



or equivalent figure

Operation of resistors split single phase induction motor:

- In resistors split phase I.M shown in above figure 'a', the main winding has low resistance but high reactance whereas the starting winding has a high resistance, but low reactance.
- The resistance of the starting winding may be increased either by connecting a high resistance 'R' in series with it or by choosing a high-resistance fine copper wire for winding purpose**.**
- Hence as shown in fig. 'b' , the current I_S drawn by the starting winding lags behind the applied voltage V by a small angle whereas current I_m taken by the main winding lags behind V by a very large angle.
- Phase angle between I_S and Im is made as large as possible because the starting torque of a split-phase motor is proportional to sin α .
- A centrifugal switch S is connected in series with the starting winding and is located inside the motor.
- Its 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 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

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

Ans: **(Any four parts expected: 1 Marks each)**

S.No.	Parts	Material
1	Stator frame	Cast iron or cast aluminum alloy
2	Stator core	Silicon steel
3	Rotor bars	Aluminum
4	Shaft	Steel
5	Slip ring	Graphite or metal contact brass ring
6	Slip ring brushes	Graphite or metal contact
7	Stator winding	Copper conductors
8	rotor winding	Copper conductors

f) What is the importance of improvement in power factor? State any two methods for power factor improvement.

Ans: **Because of following advantages of high power factor improvement of power factor is important:** **(Any Two Important are expected: : 1 Mark each)**

We know that, $P = \sqrt{3}\ V_L\ I_L\ Cos\phi$

- For same power to be transmitted at same voltage over a same distance

$$I \alpha \frac{1}{Cos\phi} \alpha \frac{1}{P.f}$$

- From above equation it is seen that as power factor increases current decreases, due to decreases in current, system has following advantages

	Cross section of conductor reduces: Cross section of conductor α I $\alpha \frac{1}{P.f}$ As P.F. increases current reduce so; cross section of conductor and its weight reduces hence its cost reduces **1. Design of supporting Structure:** As weight of conductor reduces design of supporting structure (tower) becomes lighter, so its cost reduces. **2. Cross section of terminal (contacts) reduces:** As power factor increases, current reduces. hence cross section of switchgear bus bar and contacts etc decreases. **3. Copper losses reduces:** As power factor increases current reduces. So copper losses reduces. As a effect efficiency increase. **Voltage drop reduces:** As P.F. increases, current decreases. So voltage drop decreases, So regulation gets improved (better) **4. Handling capacity (KW) of equipment increases:** As power factor increases, handling capacity of each equipment such as Alternator, transformer increases. **5. KVA rating of equipments reduces:** As P.F. increases, current decreases. So KVA rating of all equipments for eg- alternator, transformer etc decreases, so its capital cost reduces. **Methods for power factor improvement.** **(Any Two methods expected: 1 Mark)** 1) By use of static capacitor (Condenser) 2) By use of over excited synchronous motor (Synchronous condenser) 3) By use of over excited Schrage motor 4) By use of phase advancer
Q.3	**Attempt any FOUR of the following:** **16 Marks**
a)	**A furnace takes a current of 10 Amp from a 220 V, dc supply for eight hours. Calculate the energy consumed in KWh.**
Ans:	**Given Data:** I = 10 A, V = 220 V Power 'P' = V I ---------- **(1 Mark)** Power 'P' = 220×10 Power 'P' = 2200 Watts or 2.2 kW ---------- **(1 Mark)**

Energy Consumed :

Energy consumed = Power in (KW) x Time in (Hr) ---------- **(1 Mark)**

Energy consumed = 2.2 x 8

Energy consumed = 17.6 kWh ---------- **(1 Mark)**

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

Ans:

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.

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

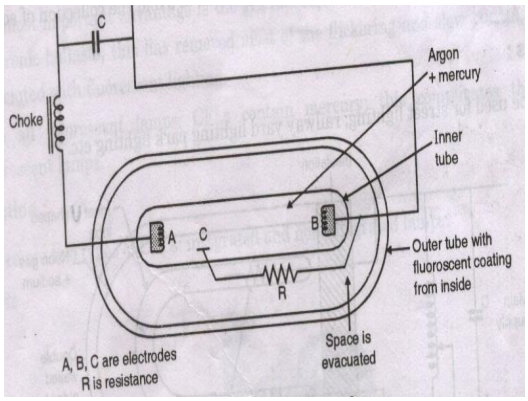
Whenever motor is overloaded due to any reason due to this overload coil motor will become off automatically.

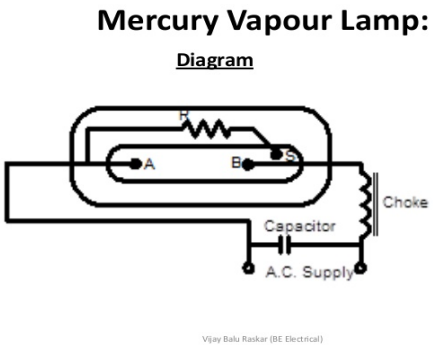
c) Describe the operation of mercury vapour lamp with neat connection diagram

Ans:

➢ **Figure Mercury Vapour discharge lamp :-**

(Figure: 2 Mark, Working : 2 Mark)





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

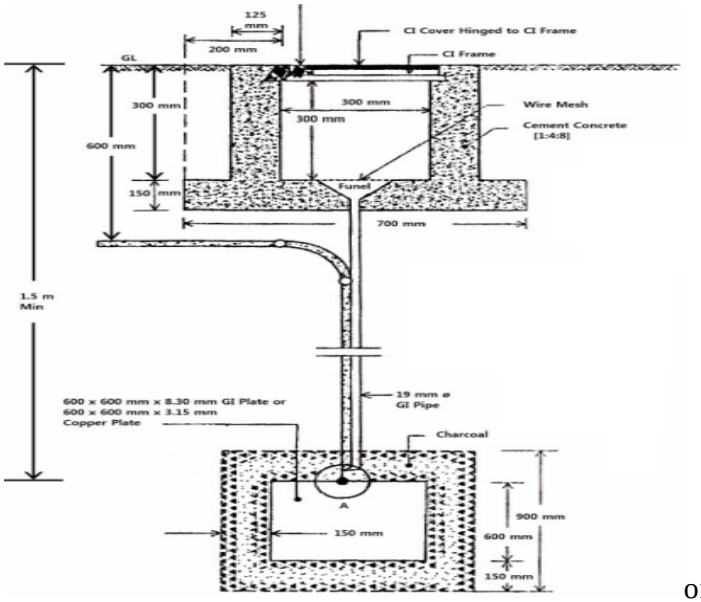
- MV lamps consist of an arc tube (inner) enclosed by an outer tube.
- Vacuum is created between the inner & outer glass tube to prevent heat loss/ the space between the two is filled with nitrogen.
- The inner bulb contains neon or argon gas with certain quantity of mercury.
- Arc tube also contains two electrodes and starting electrode.
- It requires a ballast to give high voltage at staring to 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 vaporizes mercury vapor
- The energized mercury vapor atoms emit light.
- After 5 minutes, the lamp gives full light.
- It gives greenish blue color light

d) Draw neat diagram explain plate earthing

Ans: Diagram of plate earthing: **(2 Mark)**



or equivalent diagram

Explanation: **(2 Mark)**

Explanation:

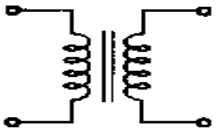
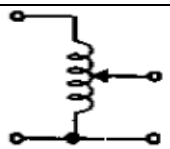
- Excavation on earth for a normal earth Pit size is 1.5M X 1.5M X 3.0 M.
- **Specifications:** Generally for plate type earthing normal Practice is to use GI earthing plate of required size.
- OR Copper plate of size 600 mm x 600 mm x 3.15 mm.

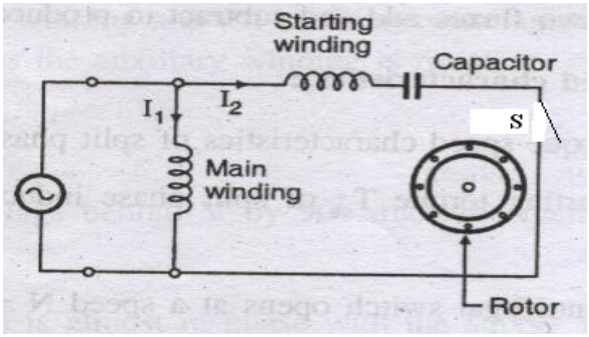
  Plate burred at the depth of 3 mtr. in the vertical position

- These types of earth pit are generally filled with alternate layer of charcoal & salt up to 4 feet from the bottom of the pit.
- Prepare a Concrete chamber
- Make arrangement with the help of G.I. pipe , funnel for pouring the water in earth pit when required.
- The electrical installation which to be earthed, is connected to the plate by means of copper or aluminium earth continuity strip of sufficient cross-section.
- and GI strip bolted with the plate is brought up to the ground level or Cu Strip is used if Copper plate is used.

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

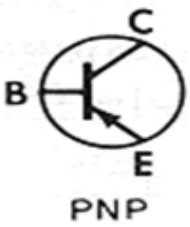
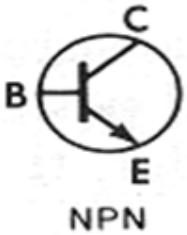
Ans: **(Any four points expected: Each point 1 Mark)**

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.

f)	**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.

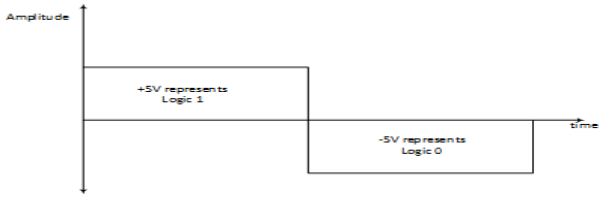
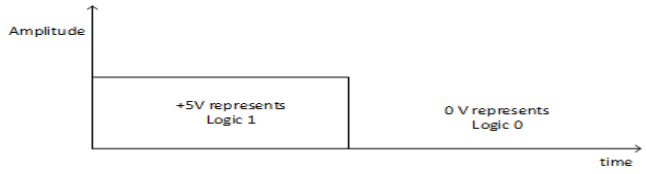
---------- **(END PART-I)** ----------

SECTION — II

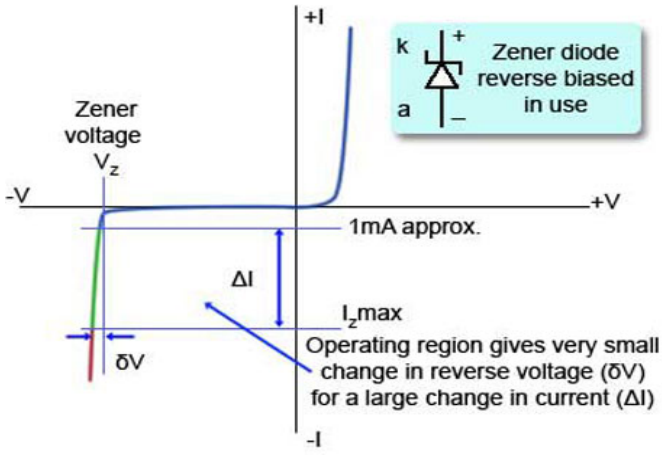
Q.4	Attempt any NINE of the following: 18 Marks
a)	**Define doping**
Ans:	**Doping:** (2Marks) **Doping** is the process of adding impurities to intrinsic **semiconductors** to alter their properties
b)	**Draw symbol of PN junction diode and give one application of the same.**
Ans:	**Symbol of PN junction diode:** (1 Mark)  **Applications : - (Any one application) ----------(1Mark)** 1) Used as a rectifier 2) Clippers & Clampers 3) Used as switch
c)	**What is breakdown in diodes? State its types.**
Ans:	**Meaning of breakdown in diodes** : (1 Mark) The breakdown voltage of a diode is the minimum reverse voltage applied to make the diode to conduct in reverse direction. **Types of breakdown in diodes:** (1 Mark) 1) Avalanche breakdown 2) Zenner breakdown
d)	**Draw symbol of following with all indications i) PNP Transistor ii) NPN Transistor**
Ans:	**i) PNP Transistor:** **ii) NPN Transistor** (Each Transistor: 1 Mark)  PNP  NPN

e)	**Enlist applications of transistor.**
Ans:	**Applications of transistor** : **(Any Four application are expected: 1/2 Mark each)** 1) Transistor used as a voltage amplifier 2) Transistor used as a power amplifier 3) Used as Switch. 4) Used in digital circuits as – memory, gates. 5) Used in Oscillators &Multivibrators 6) Used in Time base generators.
f)	**Define filter**
Ans:	**Filter:** **(2 Mark)** Filters are circuits which are used to remove unwanted AC components from the output of rectifier.
g)	**Enlist the types of filter.**
Ans:	**Types of filter –** **(2 Mark)** 1. Inductor filter, 2. Capacitor filter, 3. LC filter, 4. π or CLC filter
h)	**Define voltage regulator**
Ans:	**Voltage regulator:** **(2 Mark)** 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
i)	**State truth table of two input Ex-OR gate**
Ans:	**Truth table of two input Ex-OR gate:** **(2 Mark)**

Inputs		Outputs
X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

j)	**Draw symbol of light emitting diode. State any two applications of LED's.**
Ans:	**Symbol of LED:-** **(1 Mark)**  **Applications :** **(Anyone expected: 1 Mark)** 7 segment display, bar graph display, as a indiacators, monitoring & control display, 14 segment display.
k)	**What is mean by positive logic?**
Ans:	**Positive logic:** **(2 Mark)** In positive logic representation Bit 1 represents Logic high and Bit 0 represent a Logic low as shown in fig 2 a and b. High is represented by +5 Volts and low is represented by -5 Volts or 0 Volts.  Fig. 2 a. Positive logic representation  Fig. 2 b. Positive logic representation or equivalent circuit
l)	**Give important applications of SCR**
Ans:	**Applications of SCR:** **(Any four application expected: 1 Mark each)** 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. 6) In Emergency lighting System & Battery Charger.

Q.5	**Attempt any Four of the following:** **16 Marks**
a)	**Describe the operation of zenner diode and draw its V-I characteristics.**
Ans:	**V-I characteristics of zenner diode :** **(2 Mark)**



Pperation of zenner diode: **(2 Mark)**

A **Zener diode** is a diode which allows current to flow in the forward direction in the same manner as an ideal diode, but also permits it to flow in the reverse direction when the voltage is above a certain value known as the breakdown voltage, or zener voltage.

When the reverse voltage to zenner diode is increased to a large extent & when the applied voltage is sufficient to establish an electric field that can break covalent bonds and new electron hole pair gets generated. In this process no collision of electrons. And breakdown of reverse biased junction occurs.

b)	**Enlist the applications of following: (i) Resistor (ii) Inductor**
Ans:	**(i) Applications of Resistor** **(Any two can be considered: 1 Mark each)**

i) In general purpose electronic circuits to restrict current.

ii)In electronic equipments.

iii) In measuring instruments such as voltmeter, ammeter etc.

iv) In power electronic circuits

v) In Digital circuits.

(ii) Applications of Inductor **(Any two can be considered: 1 March each)**

i) In transformers.

ii) In motors & Generators

iii) In Electronic communication circuits

iv) Used where constant current required.

c) State De-morgan's second theorem and prove it with the help of truth table.

Ans: Statement of De-morgan's second theorem: **(2 Mark)**

$$\overline{A+B} = \overline{A} \cdot \overline{B}$$ DeMorgan's Theorem 2

prove it with the help of truth table: **(2 Mark)**

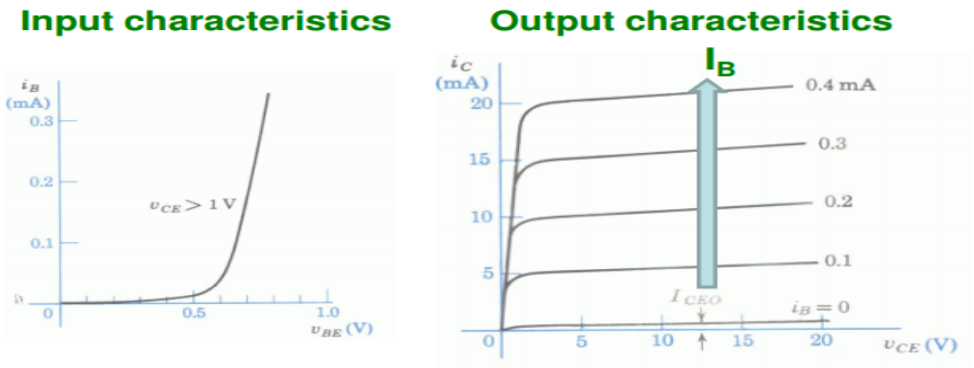
$\overline{A+B} = \overline{A}.\overline{B}$

Proof

A	B	$\overline{A}$	$\overline{B}$	$\overline{A+B}$	$\overline{A}.\overline{B}$
0	0	1	1	1	1
0	1	1	0	0	0
1	0	0	1	0	0
1	1	0	0	0	0

d) Draw & describe input and output characteristics of transistor in common emitter mode.

Ans: **Diagram of Transistor in common emitter mode:** **(2 Mark)**



Explanation: **(2 Mark)**

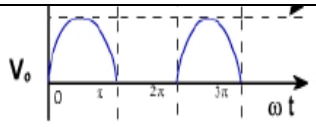
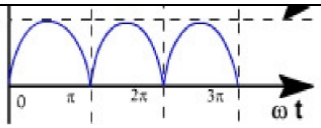
Input characteristics are like a normal forward biased diode. As the CB junction is reverse biased, the current Ic is independent of collector voltage and depends only upon the emitter current I_E . The collector current is almost constant and work as a current source.

Output characteristics is graph between VceVsIc. When base current is held constant & collector voltage is increases, the collector current increases linearly & goes to saturation after certain value of Vce.

e) Compare half wave and full wave center tapped type rectifier.

Ans:

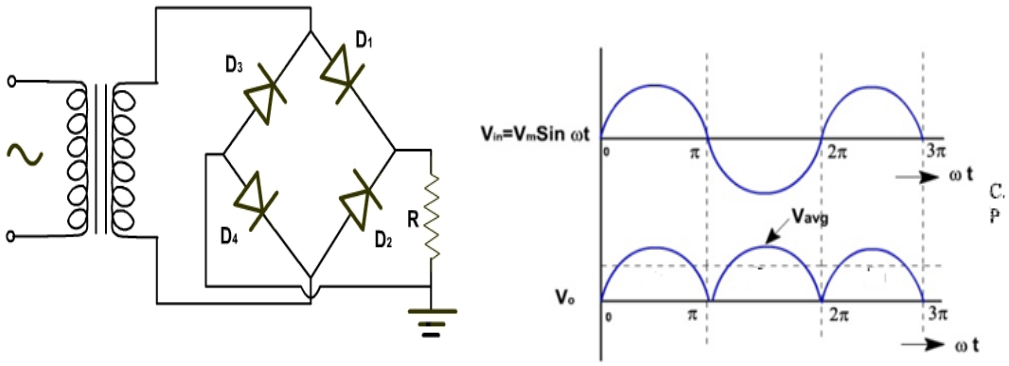
(Any four point expected: 1 Mark each)

S.No.	Parameter	Half wave	Full wave center tapped
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
3	**efficiency**	40.6 %	81.2 %
4	**ripple factor**	1.21	0.48
5	**output waveform**		
6	**Peak Inverse Voltage (PIV)**	Vm	2Vm
7	**DC Output Voltage**	V_m/π	$2V_m/\pi$
8	**Ripple frequency**	50 Hz	100 Hz

f) Explain bridge rectifier with the help of diagram

Ans:

Diagram of Bridge rectifier: **(Diagram: 2 Mark & Explanation : 2 Mark)**



or equivalent diagram

Operation : **(2 Marks)**

During positive half cycle of an AC supply, D1 & D4 will forward biased and current

starts flowing through load. The output voltage is equal to +Vs.

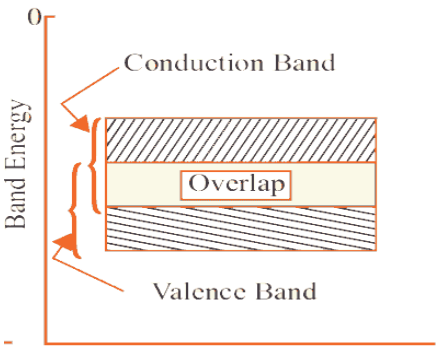
During negative half cycle of an AC supply, D2& D3 will forward biased and current starts flowing through load. The output voltage is equal to +Vs.

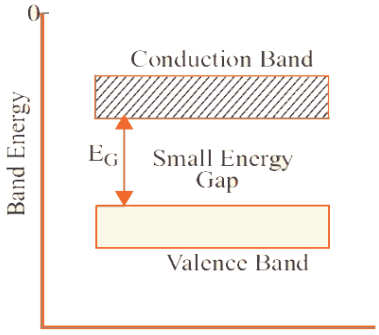
In this pulsating DC waveform will be obtained at the load.

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

a) **Explain with the help of diagram. i) Conductors ii) Semiconductors**

Ans: **i) Conductors** **ii) Semiconductor** **(Each Diagram : 1 Mark)**





i)Explanation of conductor: **(Each Explanation : 1 Mark)**

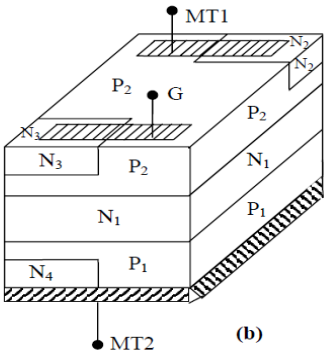
In conductors Valence band and Conduction band overlap with each other. So they are good conductor of electricity.

ii) Explanation of Semiconductor

In Semiconductors the gap between Valence band and Conduction band is very small ie. 1 eV. So the conductivity is between conductors and insulator.

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

Ans: **Diagram of TRIAC :** **(1.5 Mark)**



Working principle of TRIAC : **(1.5 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_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.

Applications of Triac :- **(1 Mark)**

Low power TRIACs are used in many applications such as light dimmers, speed controls for electric fans and other electric motors, and in the modern computerized control circuits of many household small and major appliances.

c) Compare intrinsic and extrinsic semiconductors

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

S.No	Intrinsic Semiconductor	Extrinsic Semiconductor
1	It is in pure form	It is formed by adding trivalent and pentavalent impurities
2	Holes and electrons are equal	Number of holes are more in p type and Number of electrons are more in n type
3	Fermi level lies in between valence band & conduction band.	Fermi level lies near valence band in p type &near conduction band in n type
4	Conductivity is very low	Conductivity increases by adding trivalent and pentavalent impurities

d) Draw symbol, logical expression and truth table of AND & NAND gate.

Ans:

1) Symbol, logical expression and truth table of AND gate : **(2 Mark)**

Name	Graphic Symbol	Algebraic Function	Truth Table
AND		F = A · B or F = AB	A B | F 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1

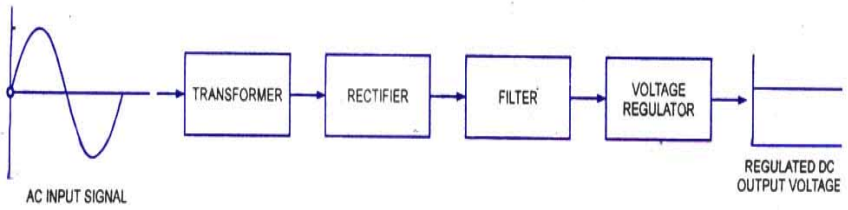
2) Symbol, logical expression and truth table of NAND gate : **(2 Mark)**

NAND		$F = (\overline{AB})$	A B | F 0 0 | 1 0 1 | 1 1 0 | 1 1 1 | 0

e) Explain block diagram of power supply in detail

Ans:

Block diagram of power supply: **(2 Mark)**



Block Diagram of a DC Power Supply

Explanation : **(2 Mark)**

1) Transformer:

It Converts an AC input source to AC required output without changing frequency. The transformer is step up or step down transformer.

2) Rectifier:

It is a circuit which is used to convert AC into pulsating DC. A rectifying diode is used.

3) Filter:

It is a circuit used to convert pulsating DC into pure DC. A inductor and capacitors are used as filter

4) Voltage regulator:

An unregulated DC voltage is converted into regulated DC voltage. IC 78XX & 79XX series are used as regulator.

f) Identify the circuit and explain it detail (Figure 1)

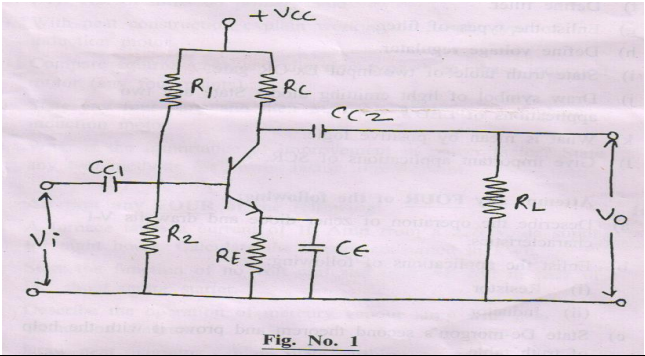


Fig. No. 1

Ans: **Single Stage RC coupled CE amplifier:** **(1 Mark)**

Explanation Single Stage RC coupled CE amplifier:- **(3 Marks)**

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

Working Single Stage RC coupled CE amplifier:-

- Resistors R1 & R2 form voltage divider biasing.
- R1, R2 & RE (emitter resistor) are used to bias the transistor in the active region, because for operating the transistor as an amplifier it is necessary to bias it in the active region.
- Rc – collector resistor is used to control the collector current.
- Cc1= Input coupling capacitor
- Cc2=Output coupling capacitor
- Ce = Emitter bypass capacitor.

1. In the absence of ac input, $I_B=I_{BQ}$, $I_C = I_{CQ}$, $V_{CE} = V_{CEQ}$. The Q point is selected in the active region of transistor.
2. As Vin is applied, the base current varies above and below I_{BQ}.

	3. Hence Ic =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. 7. Thus amplification has taken place. Vo is also 180 degree phase shifted with Vin.

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