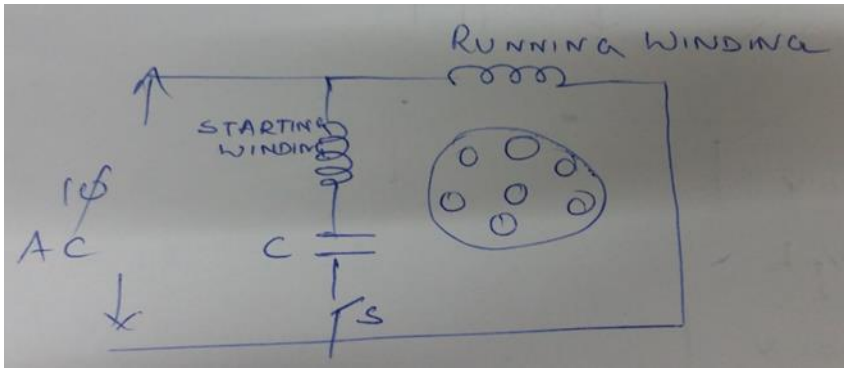
WINNTER – 15 EXAMINATIONS

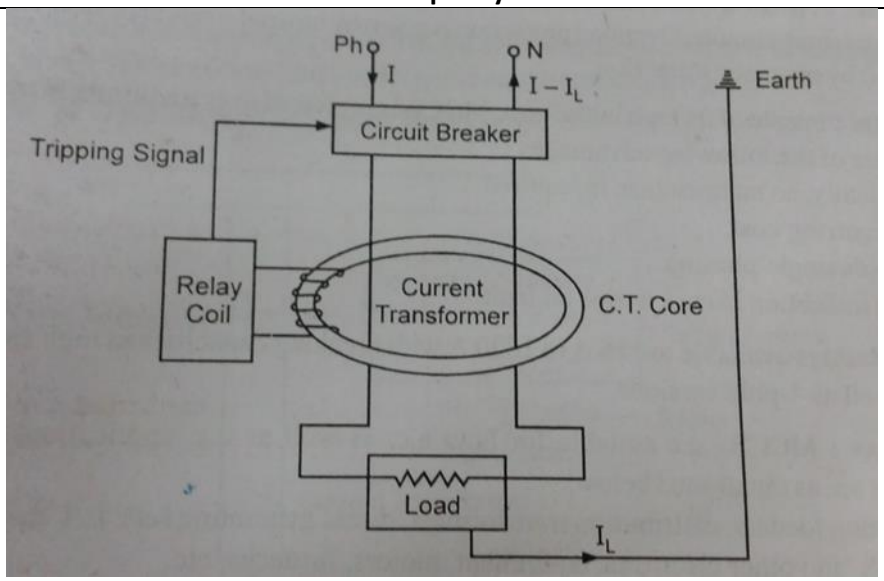
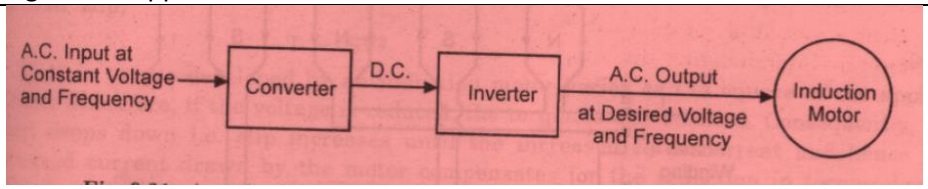
Subject Code: **17329** **Model Answer** Page No: ____/ N

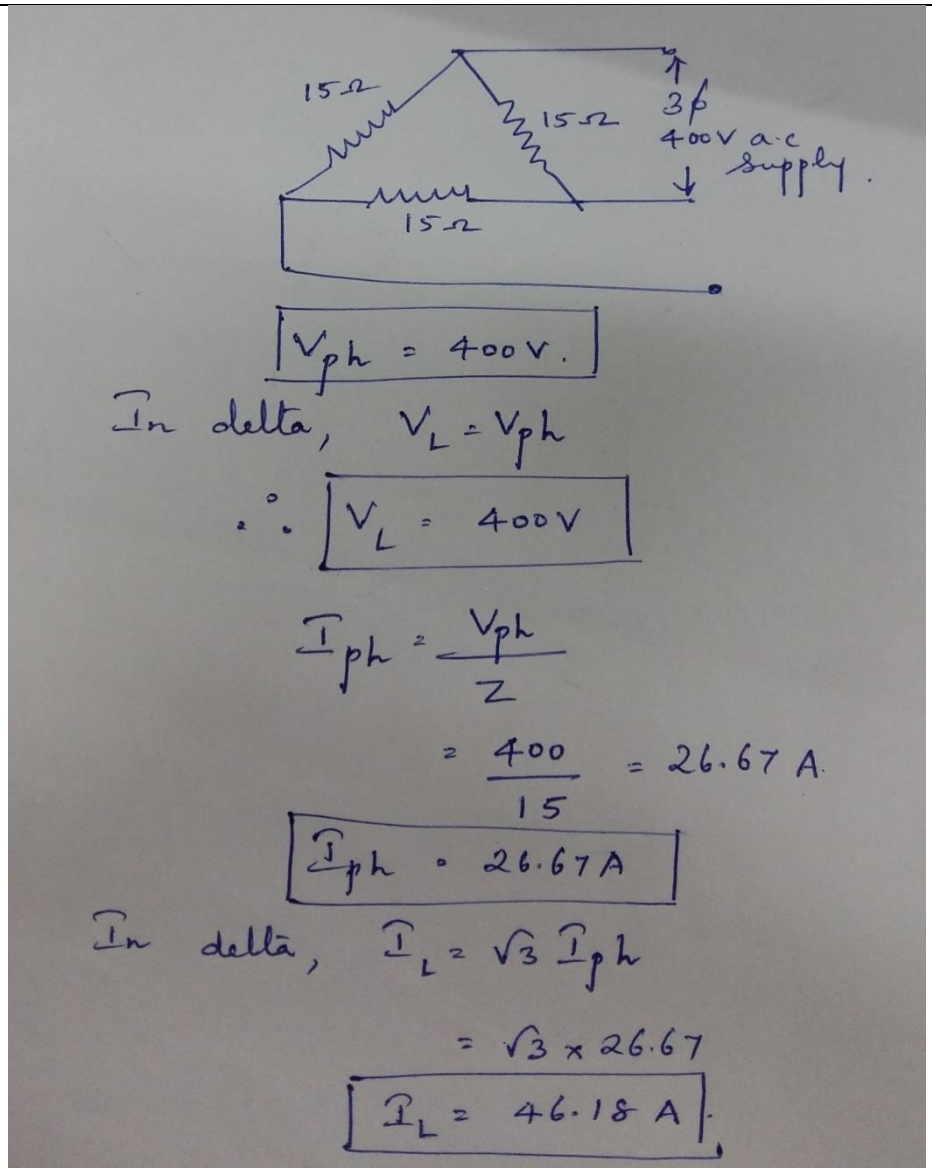
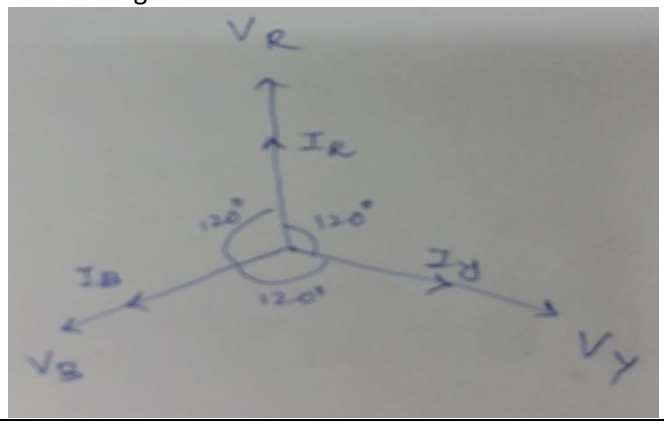
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

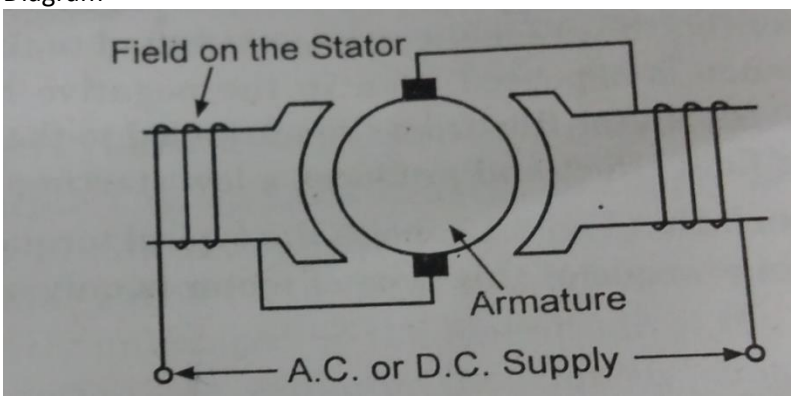
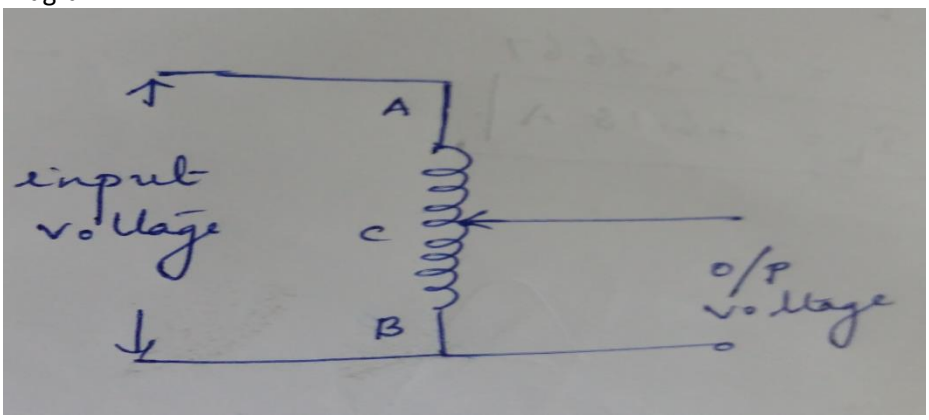
Q. NO.	MODEL ANSWER	MARKS	TOTAL MARKS
1	**SECTION-I** **Attempt any FIVE**	**5 x 4**	**20**
a)	Earthing : It means connecting to general mass of earth using a low resistance wire known as earth wire. Necessity of earthing: The purpose of earthing is to minimize risk of receiving an electric shock if touching metal parts when a leakage current is present. Earthing is to ensure safety or Protection of electrical equipment and Human by discharging the electrical leakage current to the earth. OR Earthing is provided to protect human from shocks due to leakage current. Earthing provides protection to the electrical motors and appliances due to leakage current. Earthing provides protection to the electrical motors to protect against over voltage	**2 marks for definition,** **2 Marks for necessity**	4
b)	MCCB: It stands for moulded case circuit breaker. It consists of circuit breaker and trip device assembled in a moulded case which can open and close the electric circuit in case of fault. Fuse: It is a current interrupting device. It consists of small piece of metal which melts in case of overload or fault and protects the circuit	**MCCB 2 Marks, Fuse- 2 Marks**	4
c)	Circuit Diagram:  Explanation: It consists of two windings: Starting and running or Main winding. Capacitor and a centrifugal switch is connected in series with the starting winding. Both the windings are connected 90 degrees apart. When the motor picks up speed ,the switch automatically opens and disconnects the starting winding .	**Diagram: 2 Marks** **explanation: 2 Marks**	4
d)	i) Frequency: The number of cycles completed by an alternating quantity in one second is called as frequency. ii) Phase: It is the angle between any two quantities current and voltage or	**Each definition –**	4

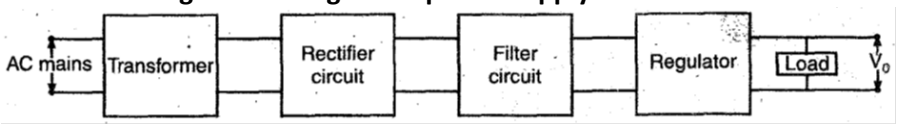
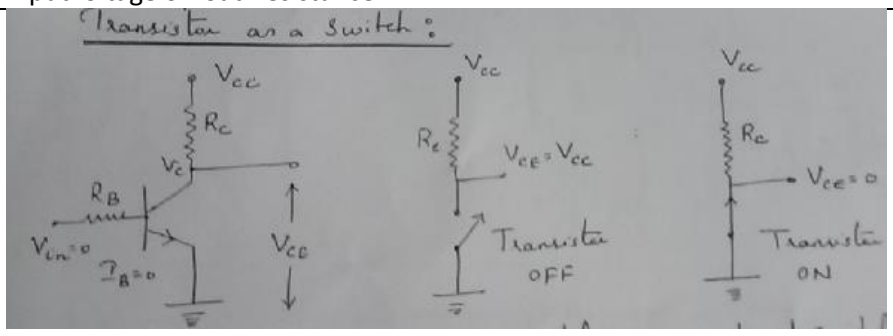
	between two same voltages and same current. **OR** Phase at any point on a given wave is the time that has elapsed since the quantity has passed through zero point of reference and pass positively. iii) Average value: The average value of an alternating current is that steady current (d.c) which transfers across the circuit, the same amount of charge as would be transferred by by alternating current across the same circuit for the same time. iv) R.M.S Value: The r.m.s value of an alternating current is that steady current (d.c) which when flowing through a given circuit for a given time produces the same amount of heat as produced by the alternating current when flowing through the same circuit for the same time.	**1 Mark**	
e)	1. The relation between line and phase values of voltage and current in star connected circuit $V_L=\sqrt{3}V_{PH}$, $I_L=I_{PH}$ 2 The relation between line and phase values of voltage and current in delta connected circuit. $V_L=V_{PH}$, $I_L=\sqrt{3}I_{PH}$	**1 Mark each for each relation**	4
f)	Application of single phase transformer: 1. As a power transformer 2. As distribution transformer 3. In welding circuit 4. In many electronic application Application of single phase autotransformer: 1. Used for starting and speed control of induction motor. 2. As variac 3. As line booster 4. As furnace transformer	**Any 2 applications each- 2 Marks**	4
g)	Voltage: The difference in potential of two charged bodies is called voltage Unit: Volt Current: It is defined as the rate of flow of free electrons in a conductor. Unit: Ampere	Definition – 1 mark, Unit- 1 mark	4

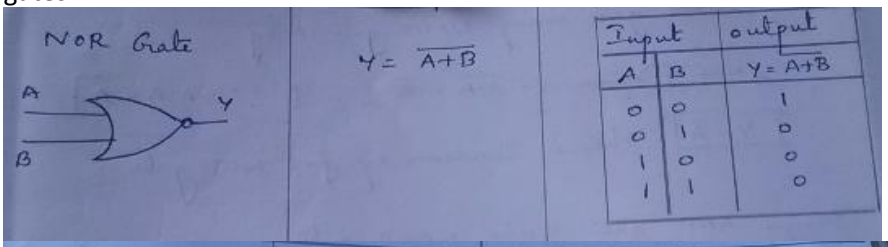
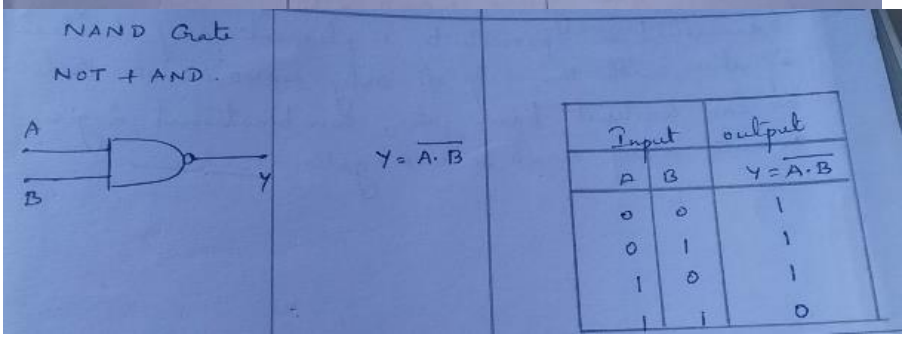
2	**Attempt any THREE**	**3 x 6**	**18**
a)	 Working: During normal conditions, currents through the phase and neutral wire are equal and opposite. But during earth fault condition, small leakage current starts returning back through the current transformer to the earthing conductor. This current energizes the relay coil which produces a tripping signal and applies it to the circuit breaker.	**Diagram: 3Marks, Working – 3Marks**	6
b)	 Working: The AC input of constant voltage and frequency is applied to the converter or rectifier which converts AC to DC. This voltage is applied as input to the three phase inverter. The output of the inverter is variable voltage, variable frequency which is applied to the stator of three phase induction motor.	**Block diagram: 3 Marks, Explanation: 3 marks**	3

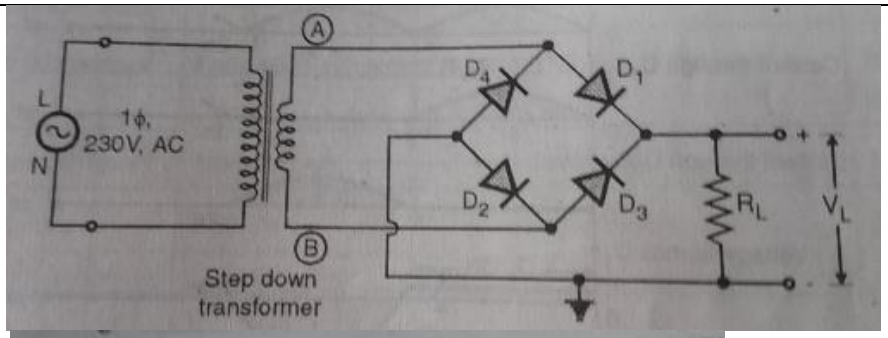
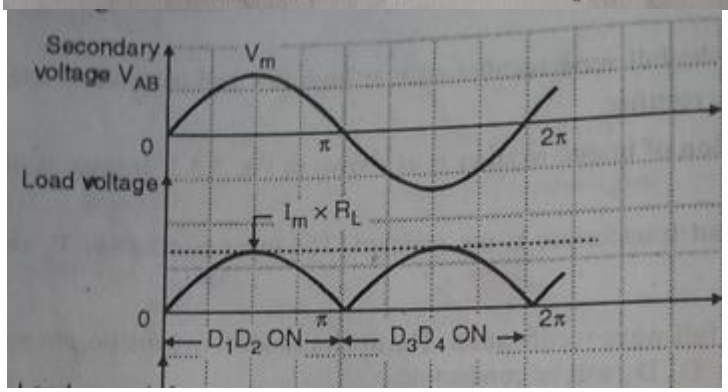
c)	 Phasor diagram: 	**Circuit diagram: 1 Mark, Iph: 1 mark I_{L1}:1 mark V_L:1 mark Vph:1 mark, Phasor diagram 1 mark**	6

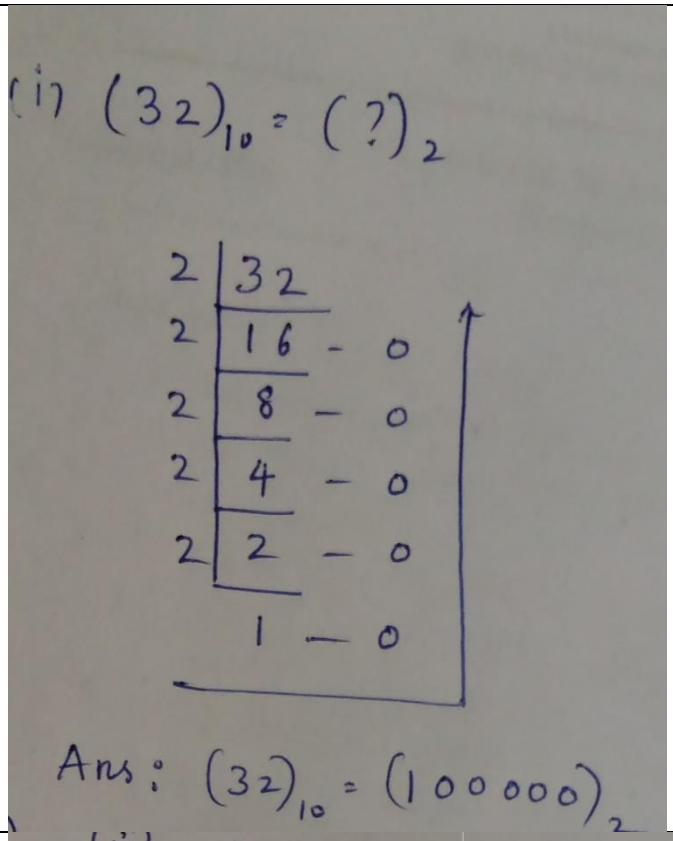
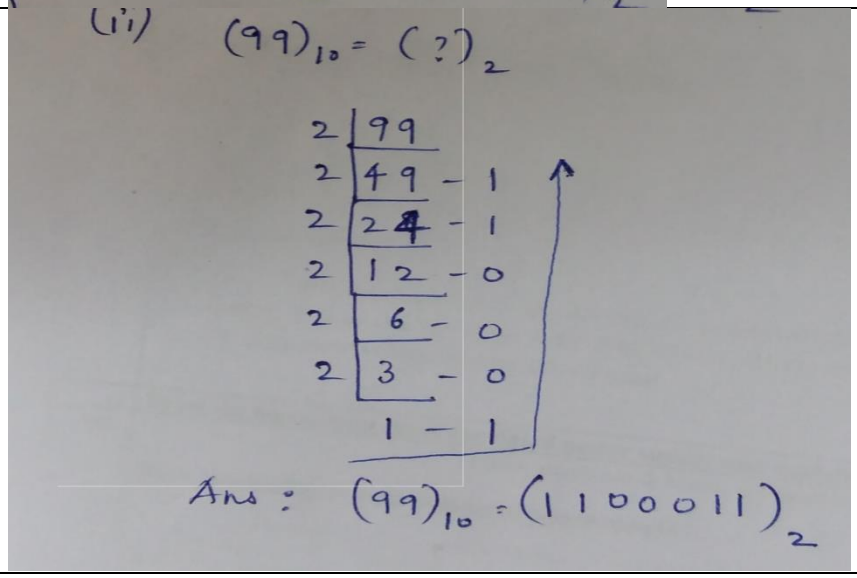
d)	Note: EMF equation of secondary side can also be considered. EMF equation of transformer in the primary side: **E_1=4.44 f N_1 Φm** **E_1**: Induced EMF on the primary side **f :** Frequency of input supply N_1: Number of turns on the primary side Φm: Maximum value of flux in the core Voltage regulation: It is defined as the change in secondary terminal voltage from No-Load to Full-Load with constant primary voltage. Note: Formula is optional and can be considered Efficiency: It is defined as the ratio of output power to input power.	**EMF equation: 2 Marks, Each term: ½ mark, each definition - 1 mark**	6
3	**Attempt any THREE**	**3 x 4**	**12**
a)	Tariff: Tariff is the way of billing energy consumed by consumer. OR The rate at which electrical energy is supplied to a consumer is known as tariff. Types of Tariff: (i) Flat-demand Tariff ii) Simple-demand Tariff or Uniform Tariff iii) Flat-rate Tariff iv) Step-rate Tariff v) Block-rate Tariff vi) Two-part Tariff: vii) Maximum demand Tariff viii) Three-part Tariff ix) Power factor Tariff	**Definition- 1 Mark and any three types- 3 Marks**	4
b)	1. Switching OFF the supply: when a person comes in contact with live conductor,switch off the main supply immediately if it is nearby or cut the wires with insulated pliers from the wiring circuit. 2. Removing the person from the contact of current:- Push a person with a dry stick of wood or pull him by using hands with insulated hand gloves, or use cotton thick cloth. 3. Removing the person from fire: If a person's cloth catches fire, then wrap him in the blanket or coat & roll him on the ground to extinguish. 4. Call doctor immediately. 5. Before doctor arrives, if any burns or wound occurs on the body of the person use proper oil/ medicine (first aid) 6. If the person is not breathing, immediately start artificial respiration until the medical aid arrives.	**Any Four Points Expected: 1 Mark each point**	4

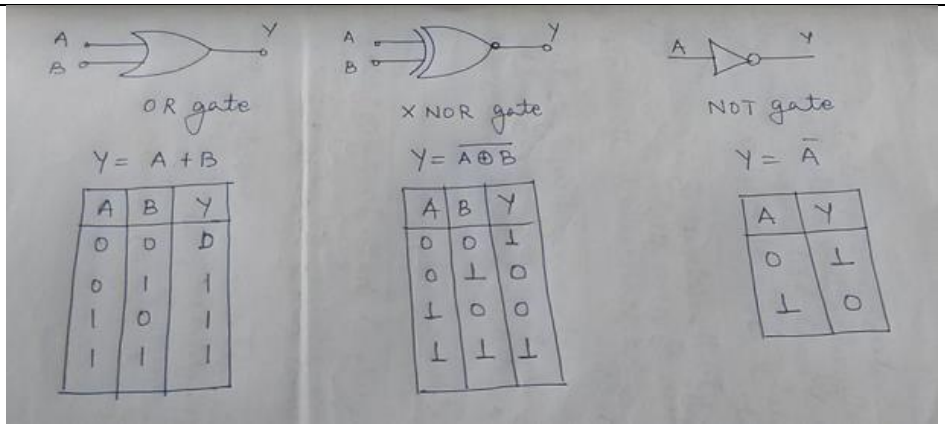
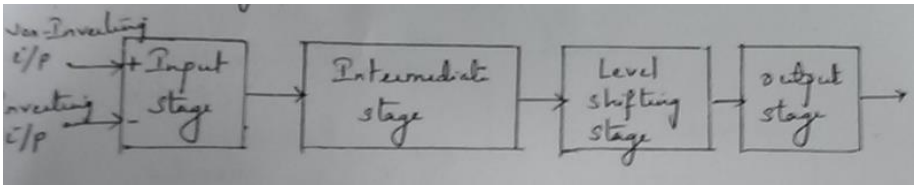
	7. Do not touch the person with bare hands. 8. Do not give liquid until the patient is conscious. 9. Give artificial respiration to the person who received electrical shocks by any one Method		
c)	Note: Any other relevant application can be considered. 1. Domestic applications 2. Solar panel 3. Small wind generator 4. Recreational vehicles	**Each application-1 Mark**	4
d)	Diagram  Explanation: It is a motor which can be operated on A.C or D.C. supply. It is similar to a D.C series motor. The field winding is connected in series with the armature. It develops a uni-directional torque. It runs at very high speed.	**diagram: 2 Marks ,** **Explanation : 2 marks**	4
e)	Diagram:  Explanation: It is a transformer with a single winding part of which is common to both primary and secondary. AB is the primary winding and BC is the secondary winding. The flux set up in the core links with primary and secondary. Specifications: 1. KVA rating 2. Turns ratio	**Diagram: 1 Mark, explanation : 2 Marks** **any two specifications- ½ Mark each)**	4

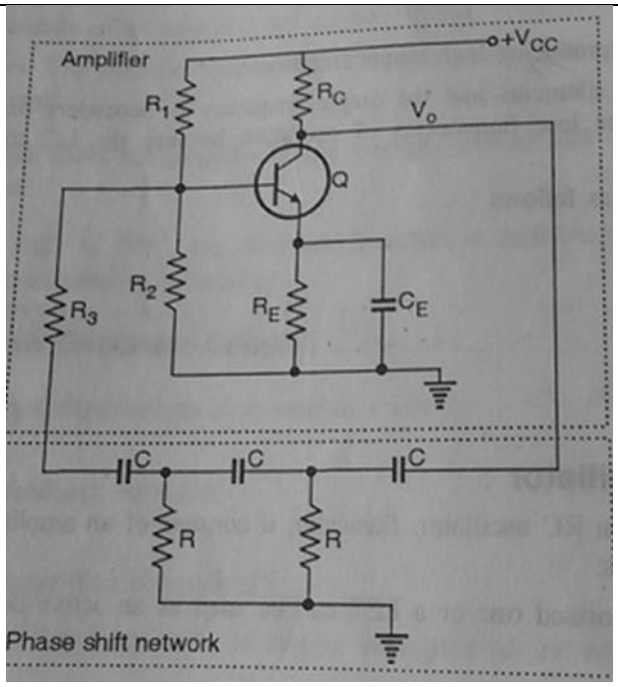
	3. Primary voltage 4. Secondary voltage 5. Class of insulation 6. Frequency of operation 7. Number of phases 8. Current		
4	**SECTION- II** **Attempt any FIVE**	**5 x 4**	**20**
a)	<table><tr><td>Sno.</td><td>Conductor</td><td>Insulator</td></tr><tr><td>1.</td><td>It has Free electrons</td><td>No free electrons.</td></tr><tr><td>2.</td><td>No forbidden energy gap</td><td>Large forbidden energy gap</td></tr><tr><td>3.</td><td>Allows current to flow easily</td><td>Does not allow current to flow easily</td></tr><tr><td>4.</td><td>Ex. Copper , aluminum</td><td>Ex. Plastic, glass, rubber</td></tr></table>	**Each point-1 mark**	4
b)	**Basic block diagram of a regulated power supply :**  **Function of each block:** **1) Transformer:** A Step down transformer is used to convert 230 V AC supply to required amount ofAC supply. **2) Rectifier:** A rectifier is an electrical device that converts alternating current AC to direct current. **3) Filter:** A filter is used to remove unwanted AC components or ripple present on the outputof rectifier. **4) Regulator:** It is used to maintain constant dc output voltage irrespective of change in inputvoltage or load resistance	**block diagram-2 marks , Each function-1/2 mark**	4
c)	 1) When Vin=0, base current Ib=0. Hence Ic=0 and transistor operates in cutoff region(both the junction emitter-base and collector-emitter are reverse biased). Transistor operates as an open switch.	**2 marks for diagram,** **2 marks for**	4

	2) When Vin is positive, large base current flows and saturates the transistor (both emitter base and collector emitter junction are forward biased). Transistor operates as a closed switch.	**explanation**	
d)	NAND and NOR gates are called as universal gates because it is possible to implement any Boolean expression with the help of only NAND or only NOR gates.  	**2 marks for reason and 1/2 mark for symbol and ½ mark for truth table for each NOR gate and NAND gate**	4
e)	**Intrinsic (pure) semiconductor:** 1) Semiconductor in its purest form is known as intrinsic semiconductor. Eg. Si(14) , Ge(32) 2) It is practically not used for manufacturing of devices. **Extrinsic semiconductor:** 1) Semiconductor in its impure form is known as extrinsic semiconductor. 2) To increase the electrical conductivity of intrinsic semiconductors impurity element is added to it. 3) The process of adding impurity is called doping. 4) Ex. N-type and p-type	**2 marks for intrinsic semiconductor and 2 marks for extrinsic semiconductor**	4

f)	  1) It consists of four diodes connected in the form of a bridge. 2) Load resistance R_L is connected in series with the bridge & output is taken across the load R_L. 3) During positive half cycle the secondary voltage V_{AB} is positive. Diode D1 & D2 are forward biased whereas D3 & D4 are reverse biased. 4) During negative half cycle the secondary voltage V_{AB} is negative. Diode D3 & D4 are forward biased whereas D1 & D2 are reverse biased.	**Circuit diagram-2 marks** **Working-1 mark** **Waveform-1 mark**	4

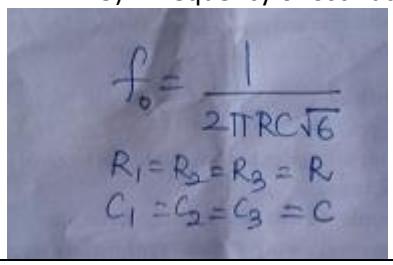
g)i		**Each conversion- 2 marks**	4
ii			
5	**Attempt any three**	**3 x 6**	**18**

a)		**1 mark each for the symbol and 1 mark each for the truth table**	6
b)	**Block Diagram:**  Explanation: 1) Input stage: It has two inputs inverting and non inverting. This stage provides most of the voltage gain of op amp and decides the input resistance. 2) Intermediate stage: This stage provides additional voltage gain to the input signal. 3) Level shifting stage: This stage is used to bring the dc level to zero volt with respect to ground. 4) Output stage: This stage increases the magnitude of voltage and raises the current supplying capability of op-amp. It also provides low output resistance.	**diagram 3 marks** **explanation 3 marks**	6
c)	**Diagram:**	**diagram 3 marks**	6

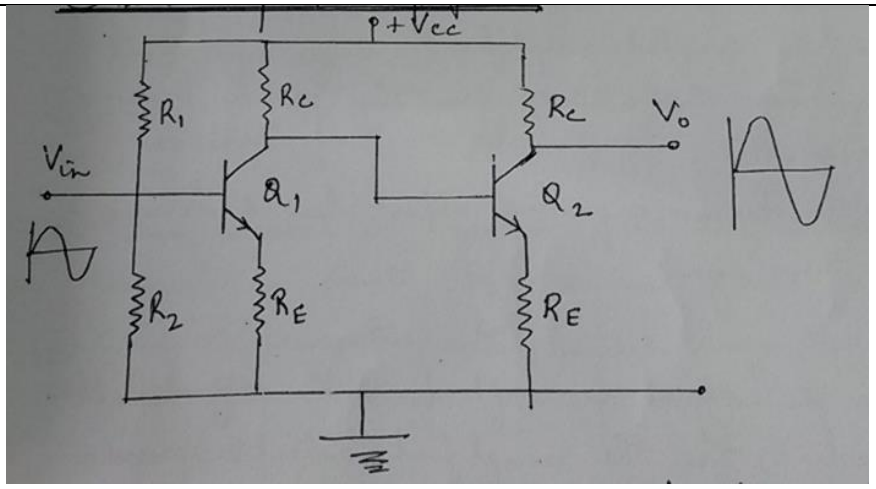
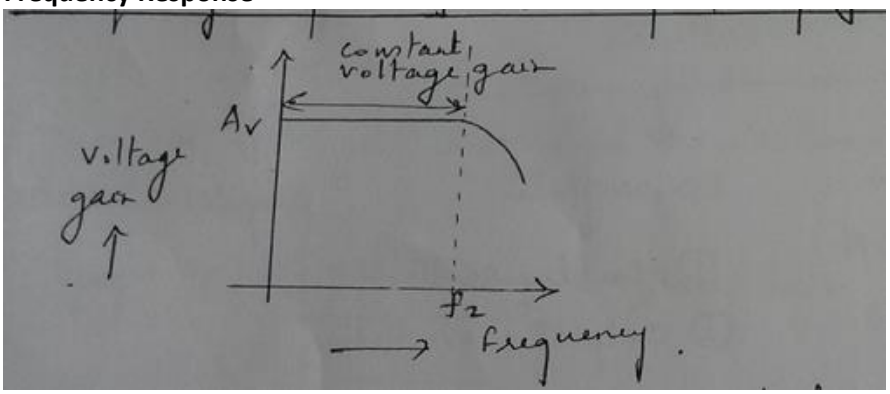


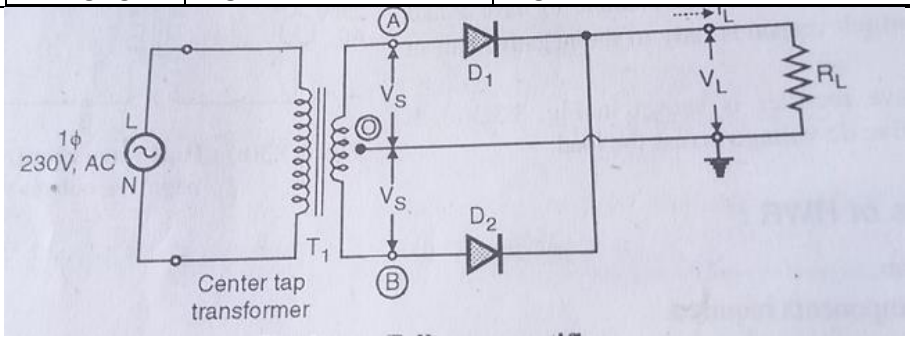
Explanation:

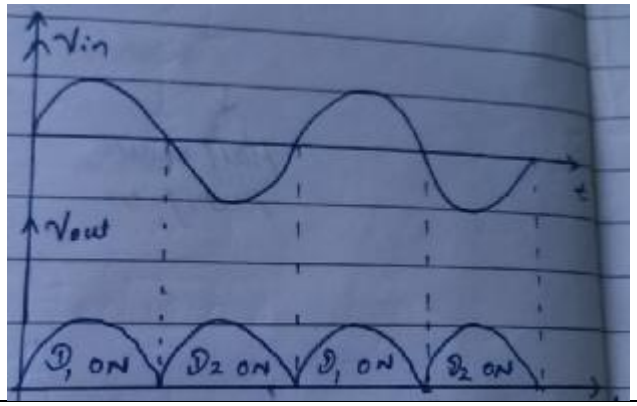
1) It consists of a single stage amplifier and a feedback network.
2) As the amplifier is CE, it provides 180 degree phase shift at the output.
3) The phase shift of 3 RC networks will introduce 180 degree additional phase shift. (Each RC network provides 60 degree phase shift.) So the total phase shift obtained will be 360 degree.
4) Thus we will get sustained oscillations at the oscillator output.
5) Frequency of oscillator is given by



explanation 3 marks

d)	 **Explanation** 1) The diagram shows two stage direct coupled amplifier. The output of the first stage is directly coupled to the input of next stage. 2) There are no coupling capacitors used. 3) The input signal is applied to the base of first transistor Q1 which amplifies the input signal. This output is given to the base of the second transistor which further amplifies the signal. 4) Voltage gain of the amplifier is constant upto frequency f2. 5) For frequencies above f2, the voltage gain reduces. **Frequency Response** 	**Diagram 2 marks ,** **explanation 2 marks and** **waveform 2 marks**	6
6	**Attempt any three**	**3 x 4**	**12**
a)	**Barkhausen's criteria of sustained oscillations:** 1) Total phase shift in the network should be 360 degree or 0 degree. 2) The product Aβ ie loop gain should be I AβI>= 1. **Applications:** 1) Signal generators. 2) Function generators. 3) Local oscillator in radio and TV receivers. 4) In TF sources.	(2 marks for criteria and {any two applications	4

<table>
<tr><td></td><td></td><td>2 marks</td><td></td></tr>
<tr><td>b)</td><td>
<table>
<tr><td>Parameter</td><td>CB</td><td>CE</td></tr>
<tr><td>Input resistance</td><td>Low</td><td>Medium</td></tr>
<tr><td>Output resistance</td><td>High</td><td>Medium</td></tr>
<tr><td>Current gain</td><td>Less than 1</td><td>High</td></tr>
<tr><td>Voltage gain</td><td>High</td><td>Higher than CB</td></tr>
</table>
</td><td>4 pts 4 marks</td><td>4</td></tr>
<tr><td>c)</td><td> 

1) It consists of a step down center tapped transformer T1, two diodes and a load resistor.
2) In the positive half cycle diode D1 conducts as it is forward biased and D2 is off since it is reverse biased.
3) In the negative half cycle diode D2 conducts as it is forward biased and D1 is off since it is reverse biased.
4) Output is obtained in both the half cycles of the ac supply, hence it is called a full wave rectifier


</td><td>2 marks for diagram, 1 marks for explanation, 1 marks for waveform</td><td>4</td></tr>
<tr><td>d)</td><td>Line or source regulation : Line regulation is defined as the change in output voltage of power supply that will occur per unit change in input voltage.

% SR = (ΔV₀/ΔV_i)*100
Where ΔV₀ = change in output voltage.
ΔV_i = change in input voltage.

Load regulation: Load regulation is defined as the change in output</td><td>2 marks for load regulation & 2 marks for</td><td>4</td></tr>
</table>

	voltage to the change in load current. **% LR= $(V_{NL}-V_{FL})/V_{FL}$ *100** V_{NL} = output voltage on no load (zero load current) V_{FL} = output voltage on full load (maximum load current)	**line regulation**	

e)

Sno.	BJT	FET
1.	It is a bipolar device	It is a unipolar device.
2.	It is a current controlled device.	It is a voltage controlled device.
3.	Low input impedance	High input impedance.
4.	High output impedance	low output impedance
5.	Noisy generated is high	Noise generated is less
6.	BJT is bigger in size	FET is smaller in size.

(any 4 pints - 1 mark for each point) — 4