WINTER-19 EXAMINATION

Subject Name: Basic Electrical and Electronics Engineering **Subject Code:** 22310

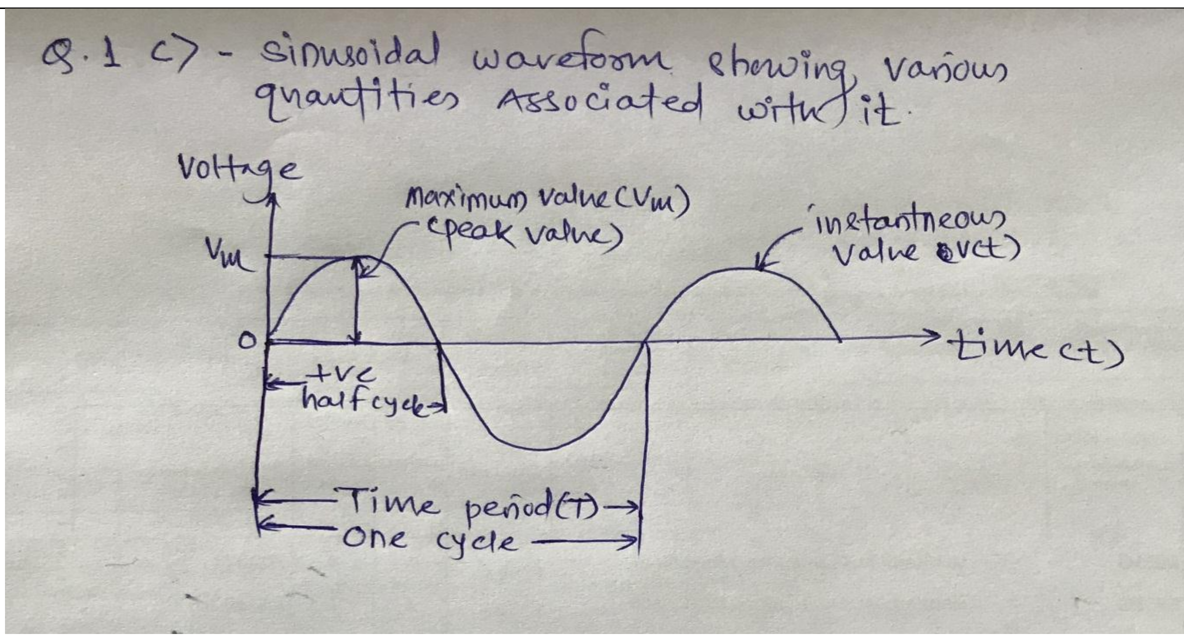
Model Answer

1

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 tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constantvalues 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 judgement 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.	Sub Q. N.	Answers	Marking Scheme
		SECTION -I	
1	**(A)**	**Attempt any SIX of the following:**	**12- Total Marks**
	(a)	**Define self induced Emf. Write equation of self induced Emf.**	**2M**
	Ans:	**Definition**: Self-induced emf is the e.m.f induced in the coil due to the change of flux produced by linking it with its own turns. Or Self induced emf is that which is induced in a coil, due to the change in its own current or flux. Self induced emf equation. $E = - N (d\Phi/dt)$ volts	**1M def** **1M eq.**

	(b)	**State Lenz's law.**	**2M**
	Ans:	**Lenz's Law:** It states that the direction of electromagnetically induced emf is such that it always opposes the main cause of its production. **Or** **It is expressed by equation** $E = - N (d\Phi/dt)$ volts Where – sign indicate the direction EMF is induced opposite to rate of change of flux.	**2m**
	(c)	**Draw sinusoidal waveform showing various quantities associated with it.**	**2M**
	Ans:		**2m**
	(d)	**Define RMS value and Average value of AC waveform.**	**2M**
	Ans:	1. **RMS value:-** For an alternating current, the RMS value is defined as that value of steady current (DC) which produces the same heat or power as is produced by the alternating current during the same time under the same conditions. $I_{rms} = 0.707\ I_{max}$ 2. **Average value:-** The average value is defined as "the average of all instantaneous	**1m each def.**

		values during one alternation. **Or** **Average value:-**average value is that value is obtained by averaging all the instantaneous values of its wave over a period of half cycle. Iav=0.637 Imax	
	e)	**State applications of single phase AC motors.**	**2M**
	Ans:	• Water pumps • ceiling fan & air conditioners. • lathe machine • washing machines. • Blowers • Mixers & grinders • Compressors • Conveyers • Refrigerators. [Note:any other relevant application can consider]	**(any two of such applications)**
	f)	**Write the Emf equation of transformer. State the meaning of each term in it.**	**2M**
	Ans:	EMF equation of Transformer:- $E1 = 4.44\ f\ \phi mN1$ OR $E1 = 4.44\ f\ BmAN1$ $E2 = 4.44\ f\ \phi mN2$ OR $E2 = 4.44\ f\ Bm\ AN2$ Let, E1 = Primary emf E2 = Secondary emf N1= Number of turns in the primary N2= Number of turns in the Secondary Øm= Maximum flux in core (wb) Bm= Flux density (wb/m2 /Tesla) A= Area of cross section of core m2 F = Frequency	**1M for each equation**

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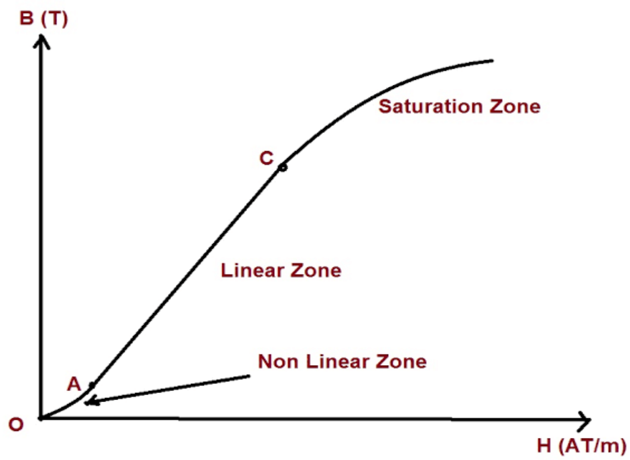
	g)	**Define-** **(i) Current** **(ii) Potential difference**	**2M**
	Ans:	**i) Current :-** electric current is defined as the movement of electronics or **flow** of electronics inside the conducting material. Unit-ampere(A) **ii) Potential Difference:** The difference between the electrical potentials at any two given points in the electrical circuit is known as potential difference between those points. Unit:- volt (V)	**1m each definition**
	h)	**State Faradays laws of electromagnetic inductions.**	**2M**
	Ans:	**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. **Second Law:** The Magnitude of induced EMF is directly proportional to (equal to) the rate of change of flux linkages.	**First law 1 Mark** **Second law 1 Mark**

Q. No.	Sub Q. N.	Answers	Marking Scheme
2		**Attempt any THREE of the following:**	**12- Total Marks**
	a)	**Draw and explain B-H curve.**	**4M**

	Ans:	**Key points** The B-H curve is the relation between Flux density B in Wb/m^2(on Y Axis) and H in AT/m (onX axis)It is also known as magnetization characteristics.  know the characteristics of magnetic material which is generally used to construct pole of an electric machine. It also gives the behavior of the material to get magnetized with rise of current (AT) Initially the material doesn't have any flux, hence the curve starts at point o. As the process of magnetization starts & current increases, the flux density in the material also increases in proportion with the rise in current. The rise in flux density with rise in current will continue up to point 'A' till maximum flux density occurs. At point 'A' material gets magnetically saturated and the curve becomes flat (parallel to X axis)	**Diagram : 2M** **Explanation : 2M**

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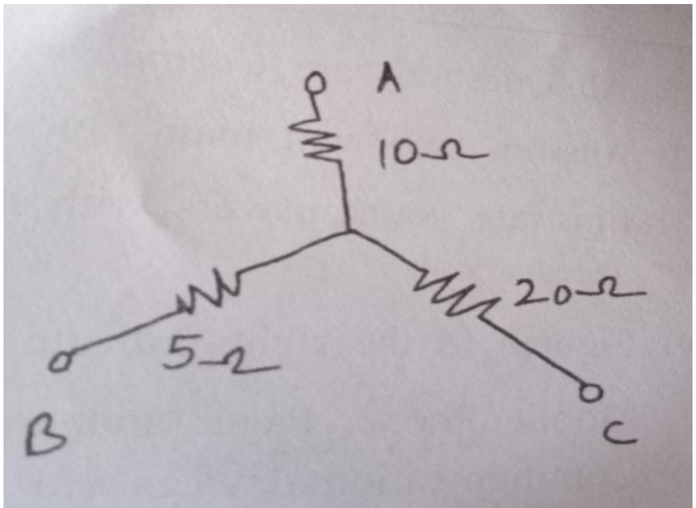
	b)	**Obtain the delta connected equivalent for the star connected circuit (fig no. 1)**  Fig. No. 1	**4M**

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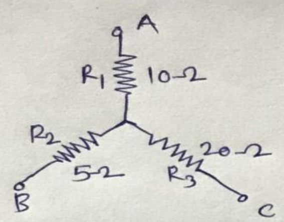
<table>
<tr>
<td></td>
<td>Ans:</td>
<td>

Given:- Star Network:



Any resistance in equivalent Delta = $\frac{\text{Total Resistance(R) in star}}{\text{Opposite Resistance in star}}$

Total Resistance in star $R = R_1 \cdot R_2 + R_2 \cdot R_3 + R_1 \cdot R_3$.

$\therefore R = 10 \times 5 + 5 \times 20 + 10 \times 20$

$\therefore R = 50 + 100 + 200$

$\therefore R = 350\,\Omega$

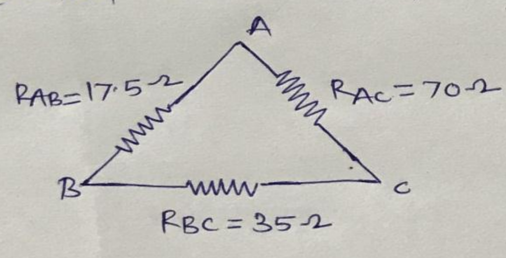
$\therefore R_{AB} = \frac{\text{Equivalent Resistance in star}}{\text{opposite Resistance in star}}$

$\therefore R_{AB} = \frac{350\,\Omega}{20\,\Omega} = 17.5\,\Omega$

$\therefore R_{BC} = \frac{350\,\Omega}{10\,\Omega} = 35\,\Omega$

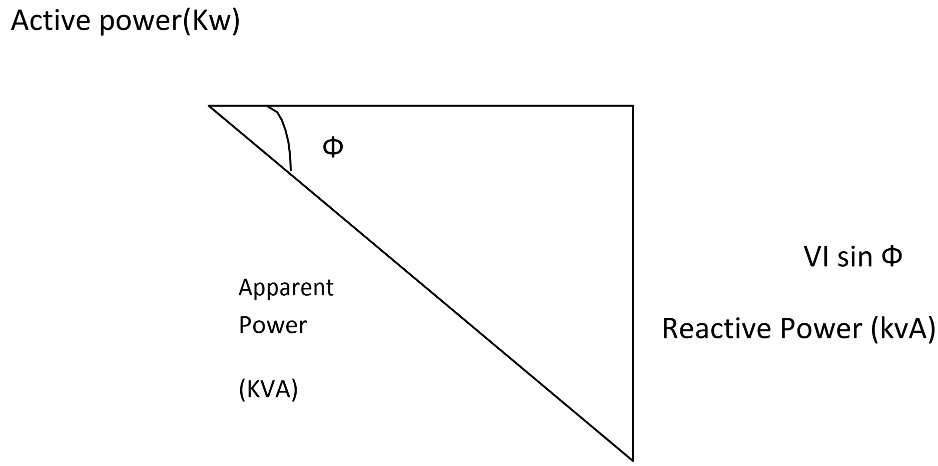
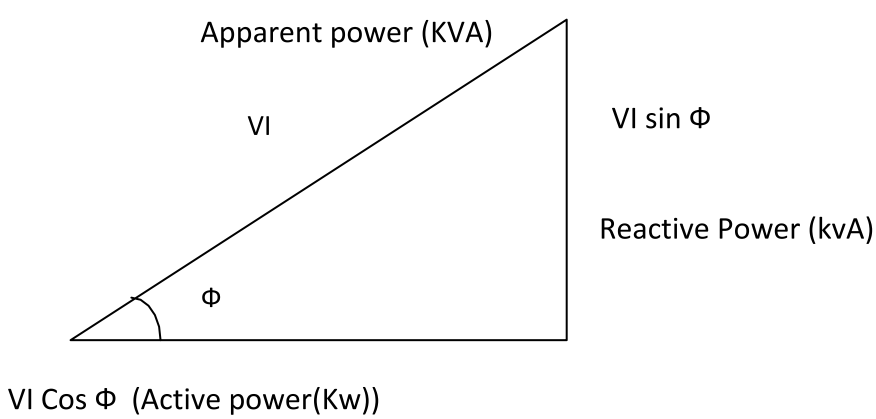
$\therefore R_{AC} = \frac{350\,\Omega}{5\,\Omega} = 70\,\Omega$

Obtained Equivalent Delta Network



</td>
<td>Each resister 1m

Eqv. Network .1m</td>
</tr>
<tr>
<td></td>
<td>c)</td>
<td>Draw and describe power triangle. State its significance.</td>
<td>4M</td>
</tr>
<tr>
<td></td>
<td>Ans:</td>
<td>Power Triangle:</td>
<td>Diagram : 2M</td>
</tr>
</table>

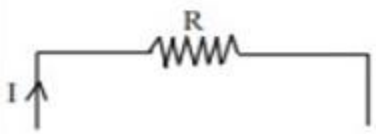
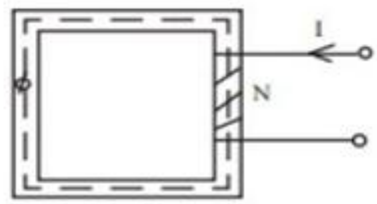
		 **OR**  Power Triangle is a right angled triangle whose sides represent the active, reactive and apparent power. It is obtained by multiplying the circuit current I, active current (IcosØ) and reactive	**Description : 1M** **Significance : 1M**

		current(IsinØ) by voltage V. Multiplication of voltage V with circuit current I, active current IcosØ and reactive current IsinØ gives apparent power (S), active power (P) and reactive power (Q) respectively. Significance of Power triangle: (Any two point expected) 1. P.F. increases current reduce so; cross section of conductor decreases hence its cost is educes. 2. P.F. increases current reduce so, cross section of conductor decreases hence weight decreases. So design of supporting structure becomes lighter. 3. Copper losses Decreases, Hence transmission efficiency increases. 4. Voltage drop reduces, hence voltage regulation becomes better 5. Handling capacity (KW) of each equipment increases as p.f. increases. 6. Less capacity (KVA) rating of equipment's are required so capital cost decreases. 7. Cost per unit (KWH) decreases. OR Significance of Power triangle : Power triangle is simply schematic representation of phasor diagram of inductive or capacitive power (reactive power) contain in load, which make power factor calculation simple. Power factor tell us the energy loss due to different load. This is very important for designing the energy efficient electrical system.	
	d)	**Compare magnetic and electric circuits (four points)**	**4M**
	Ans:		**(Any**

SR.NO	Magnetic circuits	Electric circuits
1	The magnetic circuit in which magnetic flux flow	Path traced by the current is known as electric current.

2	MMF is the driving force in the magnetic circuit. The unit is ampere turns.	EMF is the driving force in the electric circuit. The unit is Volts.	**Four Point expected : 1 Mark each)**
3	There is flux ϕ in the magnetic circuit which is measured in the weber.	There is a current I in the electric circuit which is measured in amperes	
4	The number of magnetic lines of force decides the flux.	The flow of electrons decides the current in conductor.	
5	Reluctance (S) is opposed by magnetic path to the flux. The Unit is ampere turn/weber	Resistance (R) oppose the flow of the current. The unit is Ohm	
6	$S = l/(\mu_0\mu_r a)$. Directly proportional to l. Inversely proportional to $\mu = \mu_0\mu_r$ & Inversely proportional to a	$R = \rho. l/a$. Directly proportional to l. Inversely proportional to a. Depends on nature of material.	
7	The Flux = MMF/ Reluctance	The current I = EMF/ Resistance	
8	The flux density	The current density	
9	Kirchhoff mmf law and flux law is applicable to the magnetic flux.	Kirchhoff current law and voltage law is applicable to the electric circuit.	

OR

Electric Circuit	Magnetic Circuit
	
2)E.M.F is the source to pass current	2) MMF is the source to pass flux (MMF is caused by flow of current)
3) Current in Amperes; current density in A/m^2	3) ϕ is in webbers; flux density wb/m^2
4) current $\dfrac{EMF}{Resistance}$	4) Flux = $\dfrac{MMF}{Reluctance}$
5) Resistance = R = $\dfrac{\delta l}{a}$ and is constant	5) Reluctance = $\dfrac{L}{\mu_0 \mu_r A}$ It veries as μ_r is variable
6) Conductance = 1/ R	6) Permeanance = 1 / Reluctance
7) Energy is wasted as long as the current lasts	7) Energy is required to establish the flux only and not for maintaning it.

e)	**Describe the construction and working principle of auto transformer.**		**4M**
Ans:	An auto transformer has single winding which is used as primary and secondary winding. This winding is wound on laminated enameled magnetic core.		**(Construction (diagram) - 2 marks,**

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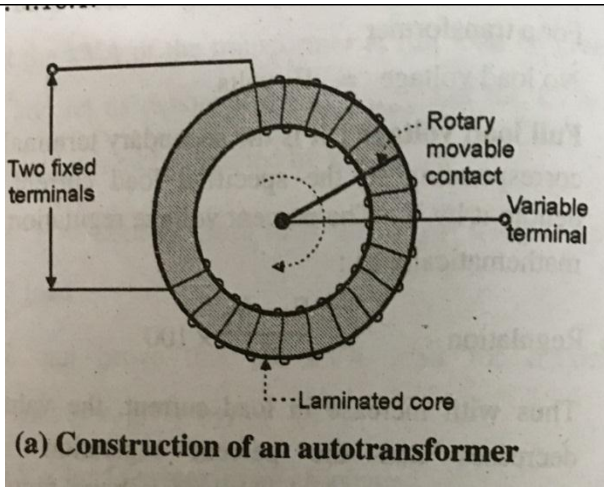
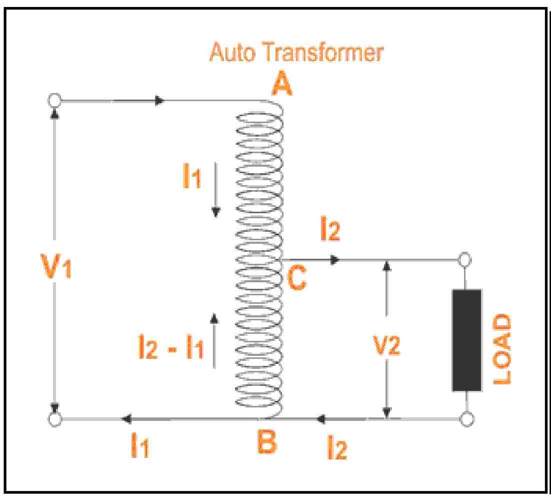
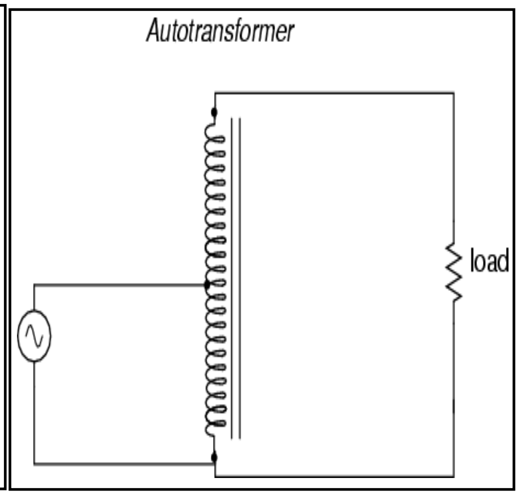
		 (a) Construction of an autotransformer **OR**   **Fig. 1 Step Down auto transformer** **Fig. 2 Step Up auto transformer** As shown in fig. 1 the input is given to winding worked as primary and output is taken from the part of the same winding. Thus the one winding serves as primary and secondary. This transformer is known as step down autotransformer As shown in fig.2 the input is given to the part of winding and output is taken across the whole winding. So the part of winding acts as a primary winding and the whole winding acts as a secondary winding. With this construction we can step up the voltage. So this transformer known as step up autotransformer.	**Working – 2 Marks)**

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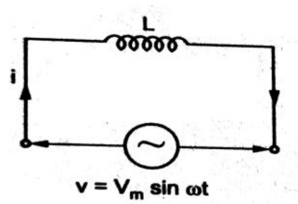
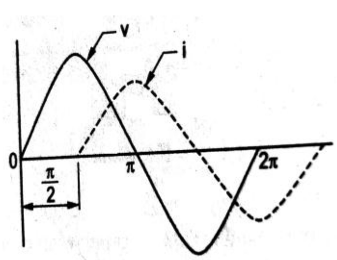
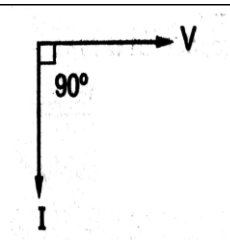
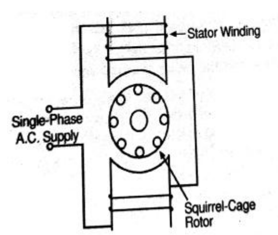
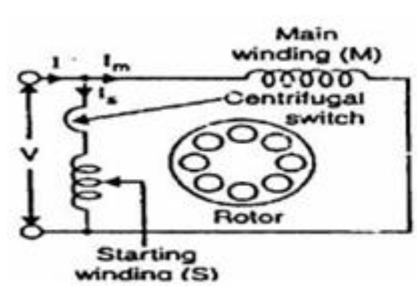
3		**Attempt any TWO of the following :**	**12- Total Marks**
	a)	**Describe the operation of inductor with sinusoidal AC voltage as input. Draw waveform for voltage across and current through the inductor. Draw its phasor representation.**	**6M**
	Ans:	An alternating voltage is applied to a purely inductive coil, a back e.m.f. is produced due to self-inductance of the coil. The back e.m.f. at every step, opposes the rise of fall of current through the coil. As there is no ohmic voltage drop, the applied voltage has to overcome this self induced e.m.f. only.  If applied voltage is represented by v = $V_m Sin\omega t$, then current flowing in a purely inductive circuit is given by $i = I_m Sin(\omega t - \frac{\pi}{2})$ Wave form of purely inductive circuit :  Phasor diagram :	**2 Marks for Description** **2 Marks for voltage and current eqution** **1Marks for waveform** **1Marks for**

			**Phasor diagram**
	b)	**Describe the construction and working principle of single phase AC motor.**	**6M**
	Ans:	construction and working principle of single phase AC motor Single phase induction motors have a phase distributed winding on the stator and a squirrel cage short-circuited winding on the rotor. When this single phase winding is connected to an alternating voltage source, an alternating field is produced varying only with time. Such an alternating field acting on a stationery squirrel cage rotor cannot produce rotation. But, if once the rotor is moved, the rotor produces a cross flux that is in both space and time quadrature with the stator flux. There are two necessary conditions to produce a rotating field. Hence, once the motor is started, the single phase motor will continue to rotate as long as the load torque is not excessive.  OR 	**2 Marks for Description** **2 Marks for working principle** **2 Marks for any relevant diagram**

[any other diagram showing AC motor can be consider]

This particulate behavior of motor has been explained in two ways i) by two field or double field revolving theory and ii) by cross field theory

Single phase induction motor is not inherently self-starting. However, if rotor is given an initial rotation in any direction, the single phase induction motor develops torque and rotor continues to pick up speed in that particular direction.

However, they are made self starting providing the various special arrangements such as split-phasing (with the help of resistance or capacitor) or using shaded poles which enable them to have a rotating magnetic field atleast at starting.

OR

- Alternating flux is produced around the stator winding due to AC supply. This alternating flux revolves with synchronous speed. The revolving flux is called as "Rotating Magnetic Field" (RMF).
- The relative speed between stator RMF and rotor conductors causes an induced emf in the rotor conductors, according to the Faraday's law of electromagnetic induction. The rotor conductors are short circuited, and hence rotor current is produced due to induced emf. That is why such motors are called as induction motors.

(This action is same as that occurs in transformers, hence induction motors can be called as rotating transformers.)

- Now, induced current in rotor will also produce alternating flux around it. This rotor flux lags behind the stator flux. The direction of induced rotor current, according to Lenz's law, is such that it will tend to oppose the cause of its production.
- As the cause of production of rotor current is the relative velocity between rotating stator flux and the rotor, the rotor will try to catch up with the stator RMF. Thus the rotor rotates in the same direction as that of stator flux to minimize the relative velocity. However, the rotor never succeeds in catching up the synchronous speed. This is the basic working principle of induction motor of either type, single phase of 3 phase.

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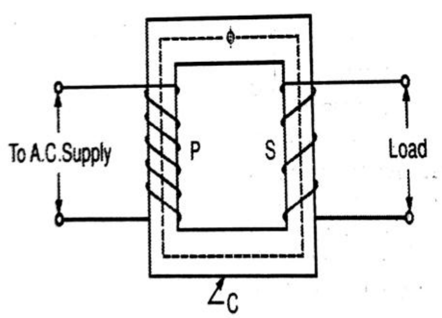
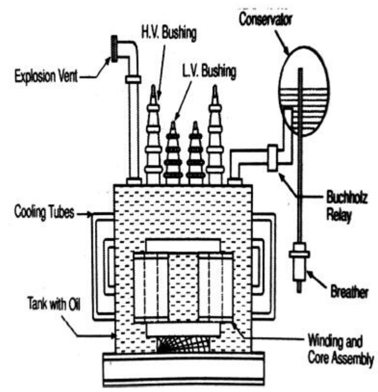
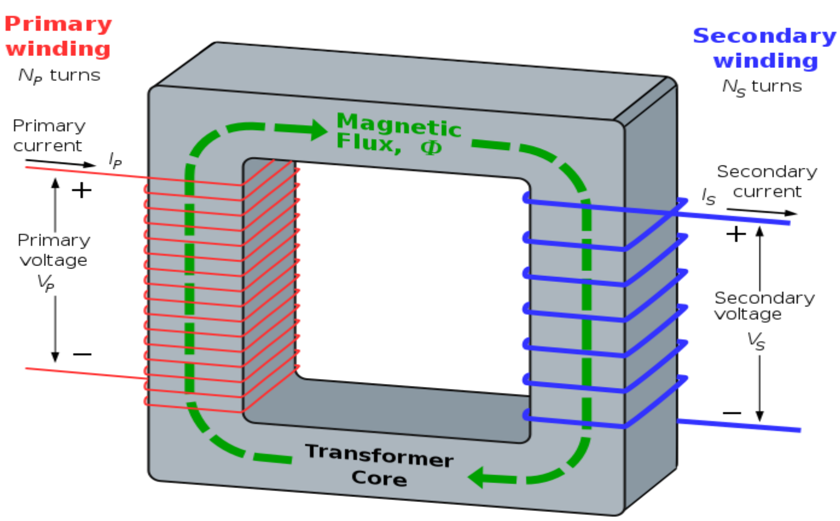
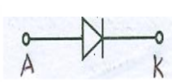
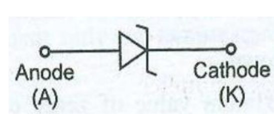
		Note : Any relevant answer should be considered.	
	c)	**State the different types of transformers. Describe the construction and general principle of transformer.**	**6M**
	Ans:	Different types of transformer are core type shell type Berry type Construction of transformer:  (OR)  OR  OR Shell Type construction can be consider for diagram	**2 marks for types of transformer** **1 mark for any relevant diagram** **2 marks for Construction**

		Transformer consists of two windings that are electrically isolated from each other. When a time varying voltage is applied to one winding, it sets up an alternating flux in the magnetic core. Due to the high permeability of the core, most of the flux links the other winding and induces and alternating e.m.f. in that winding. The frequency of the induced e.m.f. in the winding is same as that of the voltage in the first winding. If the other winding is connected to the load, the induced e.m.f. in the winding circulate a current in it. Thus, the power is transferred from one winding to the other through the magnetic flux in the core. [This answer is enough for explaining construction of transformer] [The transformer consists of following i) magnetic circuit consisting of links (core), yokes and clamping structures (providing the flux path) ii) Electric circuit consisting of primary and secondary windings iii) dielectric circuit consisting of insulation in different forms and used at different places in the transformer (core to the primary winding, primary winding to secondary winding etc). iv) Tank and accessories] this is optional answer. Principle of transformer: The operation of the transformer is based on the principle of mutual induction between two circuits linked by a common magnetic field.	**1 mark for Principle of transformer**
Q. No.	Sub Q. N.	Answers	Marking Scheme
		SECTION - II	
4		**Attempt any FIVE of the following :**	**10- Total Marks**
	(a)	**Define active components. Give two examples.**	**2M**

	Ans:	The component which requires power supply for its operation is called as Active component. e.g. Diode, Transistor, ICs, SCRs. OR **Active Component:** The component which rely on source of energy and used DC source they can amplify or rectify the signal is called active component example diode , transistor, FET, and so on. They are semiconductor component	**1mark for definition** **1 mark for any two examples**
	(b)	**State any four specifications of resistor.**	**2M**
	Ans:	specifications of resistor: 1. Resistance value 2. Tolerance 3. Power rating 4. Maximum operating temperature 5. Maximum operating voltage 6. Frequency range 7. Temperature coefficient of resistance 8. Wattage	**2 marks for any four specifications**
	(c)	**Draw symbol of –** **(i) PN junction diode** **(ii) Zener diode**	**2M**
	Ans:	**PN junction diode**  **Zener diode** 	**1 mark for each symbol**
	(d)	**State the need for filter circuits in power supply.**	**2M**
	Ans:	Ripple must be kept away from the load and it should be removed from the rectified output. Therefore , there is a necessity of filter circuit for removing i.e. smoothing or filtering the	**2 marks for stateme**

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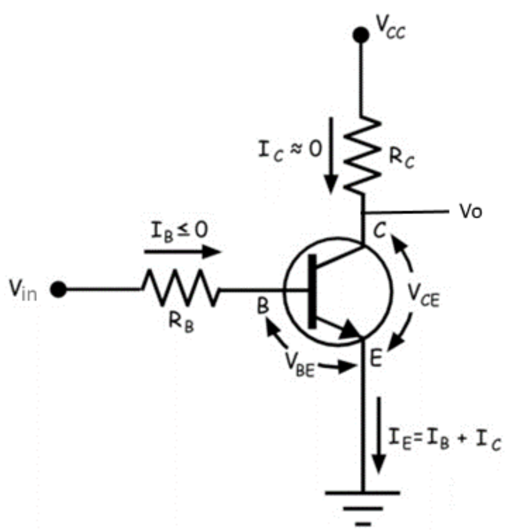
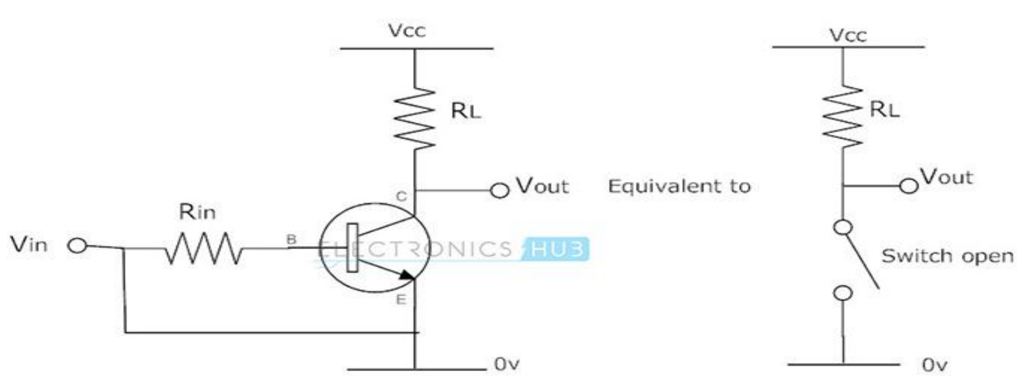
		ripple and allowing the (pure or steady) d.c. voltage to reach the load.	**nt**
	(e)	**Define α. Give the relationship between α and β.**	**2M**
	Ans:	Alpha (**α**)– It is ratio of collector current I_C to emitter current I_E of a transistor. Alpha (**α**)= I_c/ I_E **relationship between α and β** $\alpha = \frac{\beta}{1-\beta}$ **and** $\beta = \frac{\alpha}{1-\alpha}$	**1 mark for definiton** **1 mark for relationship**
	(f)	**Define the following with respect to BJT.** **(i) Input resistance** **(ii) Output resistance**	**2M**
	Ans:	**Input resistance:** It is the ratio of small change in emitter –to-base voltage(ΔV_{EB}) to the resulting change in emitter current (ΔI_E) for a constant collector to base voltage(V_{CB}) $R_i = \frac{\Delta V_{EB}}{\Delta I_E}$ / V_{CB} = constant **Output resistance:** It is the ratio of small change in collector –to-base voltage(ΔV_{CB}) to the resulting change in collector current (ΔI_c) for a constant emitter current(I_E). $R_o = \frac{\Delta V_{CB}}{\Delta I_C}$ /I_E= constant OR Input Resistance Depending on type of configuaration of BJT input resistance of BJT is ratio of voltage between input terminal and common terminal to current through input terminal. Output resistance Depending on type of configuaration of BJT output resistance of BJT is ratio of voltage between output terminal and common terminal to current through output terminal.	**1 marks Input resistance** **1 marks output resistance**

Q. No.	Sub Q. N.	Answers	Marking Scheme
	(g)	**Compare between active and passive components.**	**2M**
	Ans:	<table><tr><td>active component</td><td>passive component</td></tr><tr><td>It is a device which amplify by producing an output signal with more power in it than that of input signal</td><td>It is a device which controls or modifies the output of electronics circuit without playing an active role in its performance.</td></tr><tr><td>It includes the component such as diodes, transistors, ICs, battery etc.</td><td>It includes the component such as resistors, capacitors and inductors, conductors and transformers.</td></tr><tr><td>It may introduce the gain</td><td>It does not introduce any gain</td></tr><tr><td>It has generally unidirectional function</td><td>It has bidirectional function</td></tr><tr><td>semiconductor materials are used</td><td>Non-semiconductor or semiconductor material is used</td></tr></table>	**2 marks for any two points**

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		**Attempt any THREE of the following:**	**12- Total Marks**
	a)	**Describe the operation of transistor as a switch with suitable diagram.**	**4M**
	Ans:	In Bipolar Transistor as a Switch the biasing of the transistor, either NPN or PNP is arranged tooperate the transistor at both sides of the “ I-V ” characteristics curves. The areas of	**Diagram -**

		operation fora transistor switch are known as the Saturation Region and the Cut-off Region **Working:** Control input Vin is given to base through a current limiting resistor R_B and Rc is the collector resistor which limits the current through the transistor .When a sufficient voltage V is given to input, transistor becomes ON & it goes into saturation. During this condition the Collector Emitter voltage V_{CE} will be approximately equal to zero, ie the transistor acts as a short circuit & Vo = 0. When input voltage V=0, transistor becomes OFF & it goes into cutoff. The transistor acts as an open circuit. During this condition the Collector Emitter voltage V_{CE}=Vcc. Therefore Vo = Vcc.  OR Open switch  	1mark,operation -3marks

Closed switch

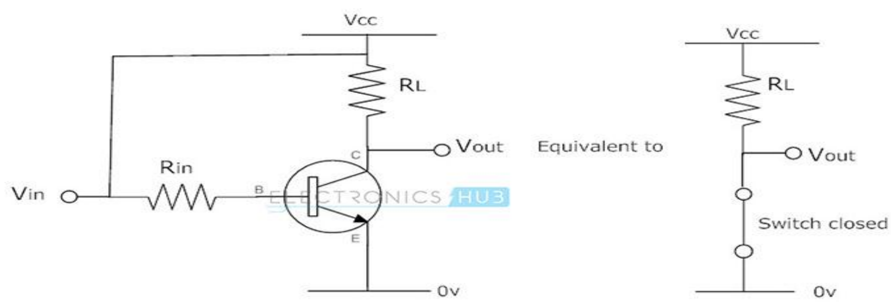


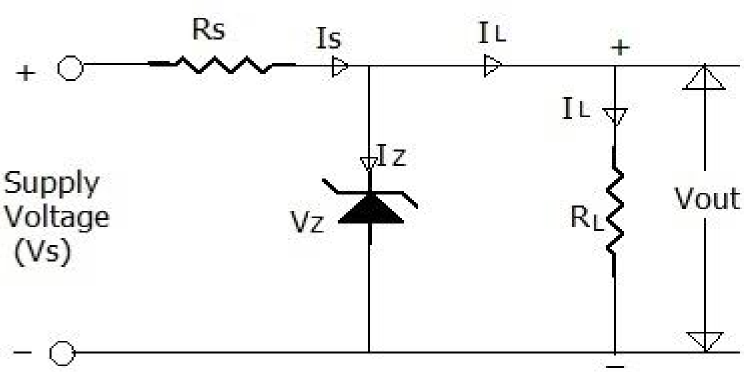
Table indicating transistor as switch

switch	Ib	Ic	VCE	LED	Transistor
open	0	0	Vcc	off	cuoff
closed	max	max	0	on	saturation

[NOTE: Table with two diagram also sufficient to explain transistor as switch 2mark for diagram and 2mark for table.]

b) **Draw and explain the operation of zener as a voltage regulator.** **4M**

Ans:



Zener diode Voltage Regulator

Diagram -2marks, operation- 2marks

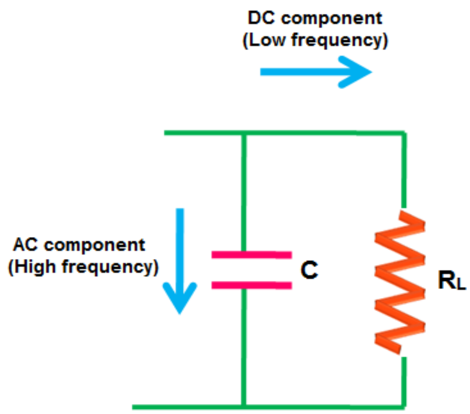
The function of a regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripples in the supply voltage or the variation in the load current

WINTER-19 EXAMINATION

Subject Name: Basic Electrical and Electronics Engineering **Subject Code: 22310**

Model Answer

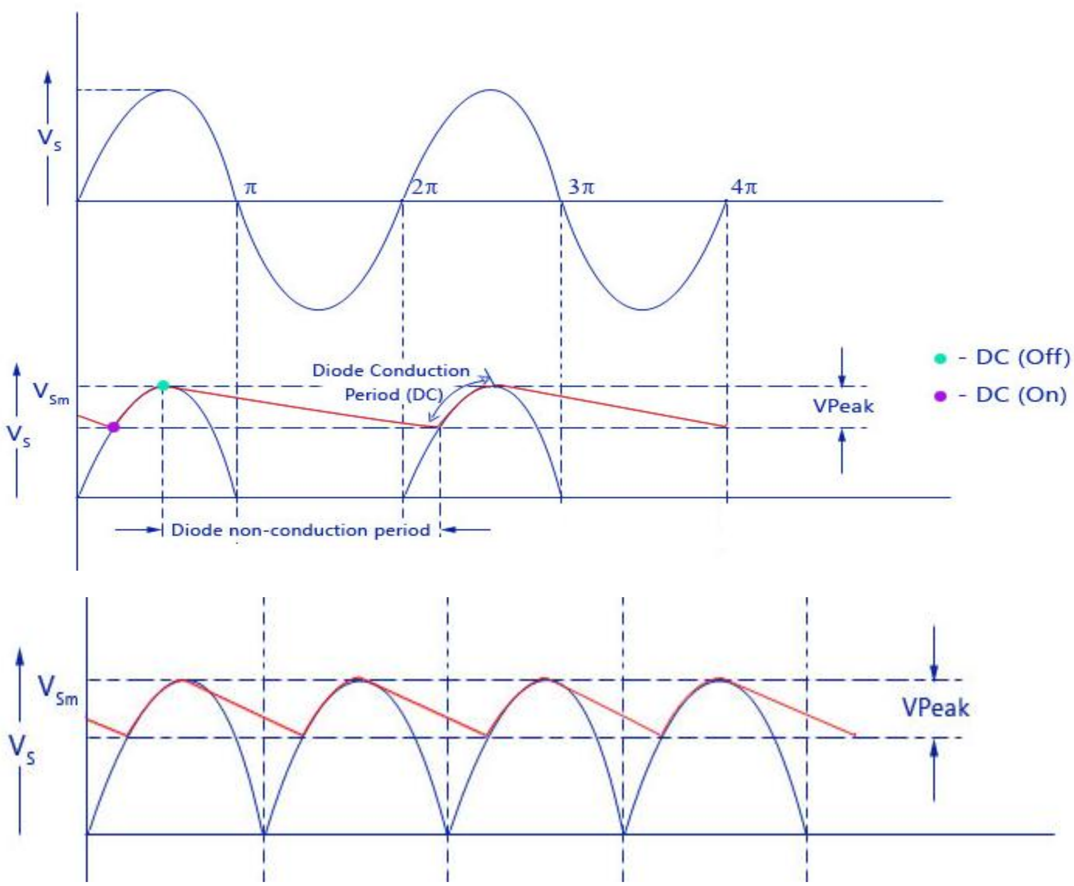
		and the zener diode will continue to regulate the voltage until the diodes current falls below the minimum $I_{Z(min)}$ value in the reverse breakdown region. It permits current to flow in the forward direction as normal, but will also allow it to flow in the reverse direction when the voltage is above a certain value - the breakdown voltage known as the Zener voltage. The purpose of a voltage regulator is to maintain a constant voltage across a load regardless of variations in the applied input voltage and variations in the load current. The resistor is selected so that when the input voltage is at $V_{IN(min)}$ and the load current is at $I_{L(max)}$ that the current through the Zener diode is at least $I_{z(min)}$. Then for all other combinations of input voltage and load current the Zener diode conducts the excess current thus maintaining a constant voltage across the load. Shunt regulators have an inherent current limiting advantage under load fault conditions because the series resistor limits excess current. A zener diode of break down voltage V_z is reverse connected to an input voltage source V_i across a load resistance R_L and a series resistor R_S. The voltage across the zener will remain steady at its break down voltage V_Z for all the values of zener current I_Z as long as the current remains in the break down region. Hence a regulated DC output voltage $V_0 = V_Z$ is obtained across RL, whenever the input voltage remains within a minimum and maximum voltage.	
	c)	**Define filter. State its types. Draw any one filter with input and output waveform.**	**4M**
	Ans:	Defination : Filter is a circuit which remove or filtered out the AC component (ripple) Types of filter 1. Shunt Capacitor filter (C filter) 2. Series Inductor filter (L filter) 3. LC filter 4. π filter (CLC filter) Shunt Capacitor filter (C filter)	**Defination-1mark,** **diagram-1 mark,** **types-1mark,** **waveform-1mark**



OR

[Any one type filter circuit diagram is enough]

Waveforms:



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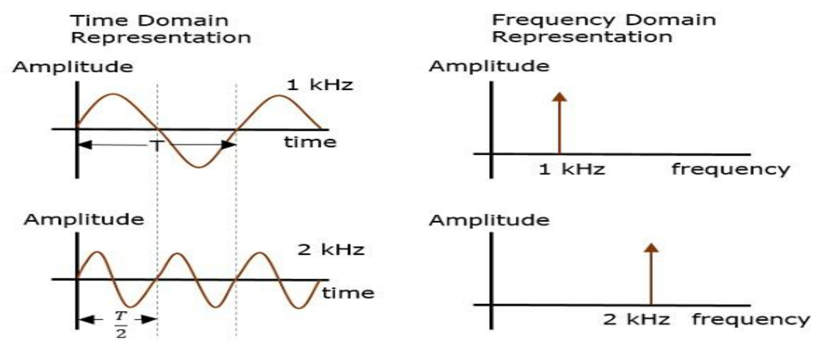
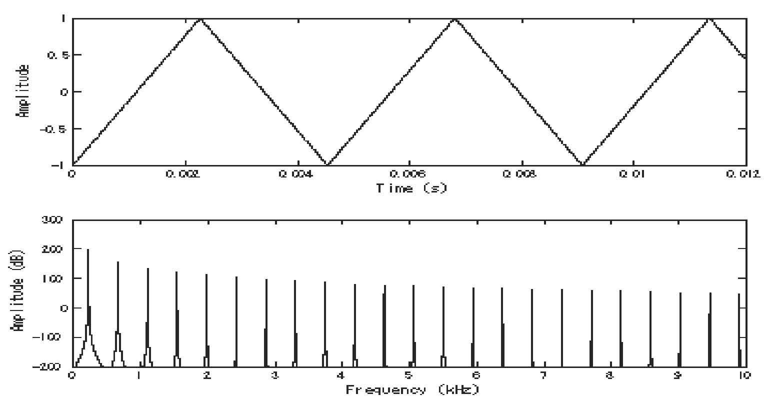
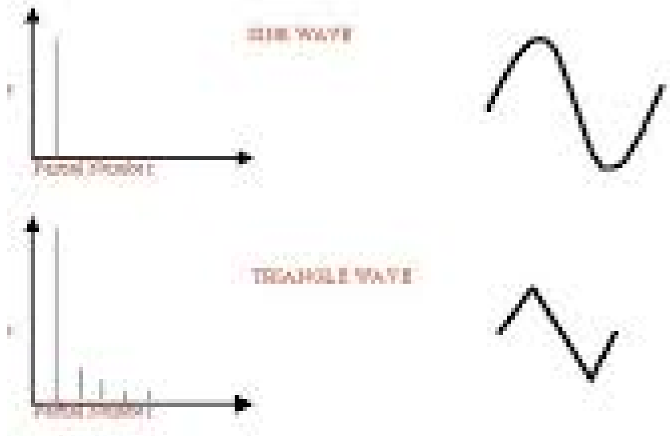
Subject Name: Basic Electrical and Electronics Engineering **Subject Code:** 22310

Model Answer

	(d)	**(i) Draw the time domain and frequency domain representation of sine wave and triangular wave.** **(ii) Define frequency and wavelength.**	**4M**
	Ans:	**(i)Time domain and frequency domain representation of sine wave**  **time domain and frequency domain representation of triangular wave.**  **OR**	**1 Mark each**

		 **ii) Define frequency and wavelength.** Frequency: Number of cycle completed in one second called as frequency Wavelength: Wavelength can be defined as the distance between two successive crests troughs of a wave.	
	e)	**(i) Discuss ideal and practical voltage source** **(ii) Compare CB, CC and CE configuration (two points)**	**4M**
	Ans:	(i) Discuss ideal and practical voltage source Ideal voltage source The ideal voltage source has a constant voltage across its terminal, irrespective of the current drawn from the source. Ideal Voltage Source have zero internal resistance. Practically an ideal voltage source cannot be obtained.	**(i)1 mark each, (ii)1/2 mark each point**

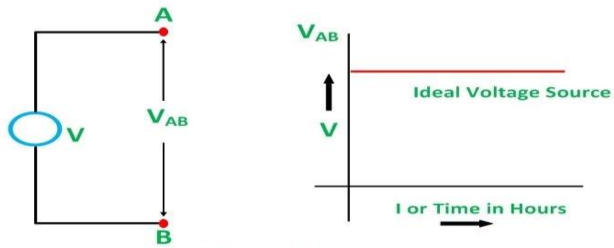


Figure A

practical voltage source

While the practical voltage source can supply only limited amount of current to the load. Also, practical voltage source has series internal resistance. due to this internal resistance; voltage drop takes place, and it causes the terminal voltage to reduce.

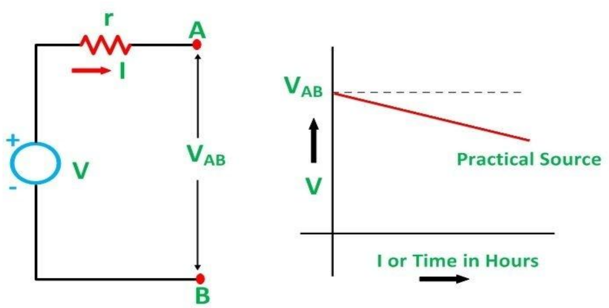


Figure B

(ii) Compare CB, CC and CE configuration (two points)

Parameter	CB	CE	CC
Input impedance	Very Low(less than 100 ohm)	Low(less than 1K)	Very High(750K)
Output impedance	Very High	High	Low
Current gain	Less than 1	High	Very high
Voltage gain	Greater than CC but less than CE	Highest	Lowest(less than 1)

OR

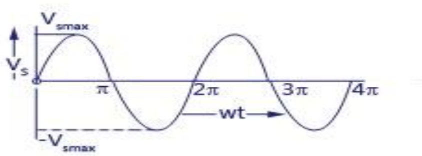
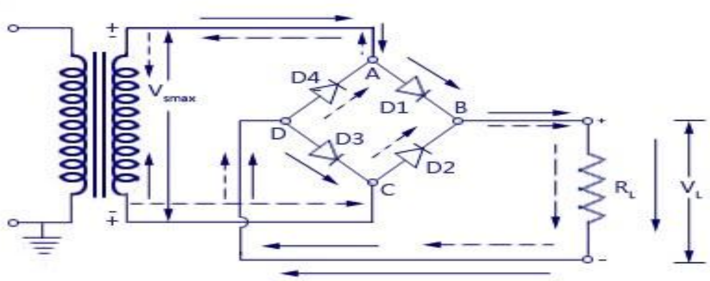
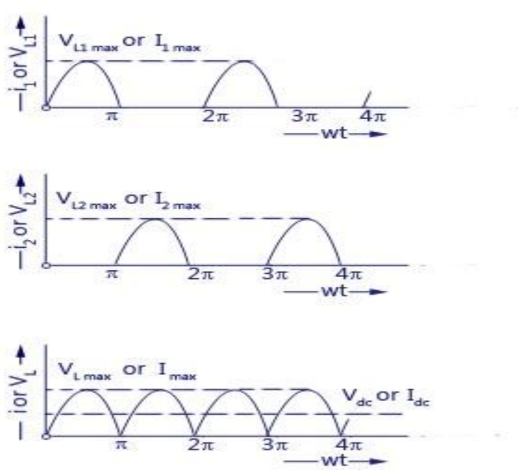
Parameter	**CB**	**CE**	**CC**
Input terminal	**emitter**	**Base**	**base**

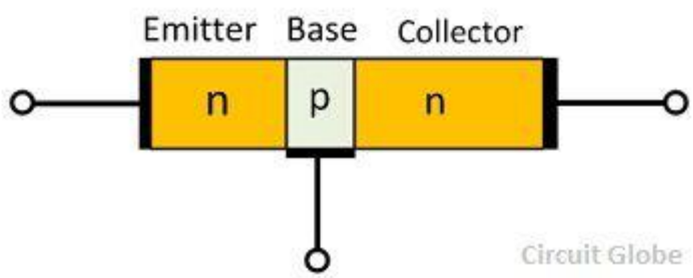
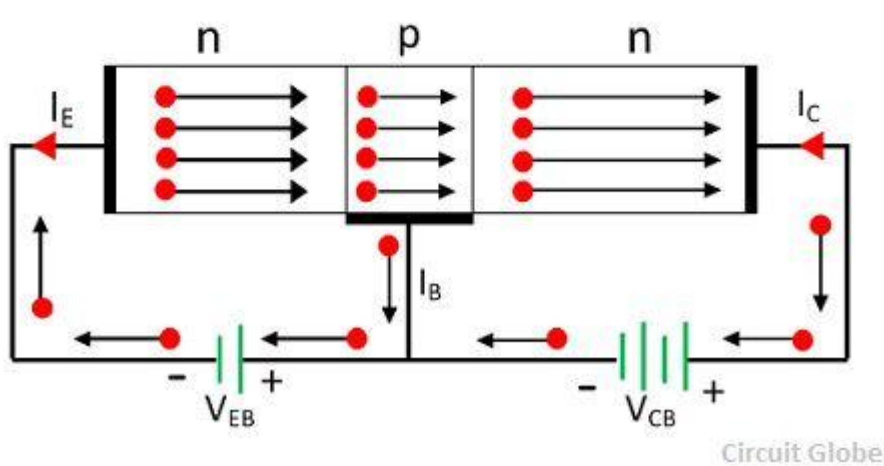
Output terminal	**collector**	**collector**	**emitter**
common	**base**	**emitter**	**collector**
Input current	**Ie**	**Ib**	**Ib**
Output current	**Ic**	**Ic**	**Ie**
Current gain	**Alpha=Ic/Ie less than 1**	Beta=Ic/Ib greater than 1	**Gamma=Ie/Ib large**
Input voltage	**Veb**	**Vbe**	**Vbc**
Input Resistance	**Medium**	**High**	**Medium**
Output Resistance	**Very high**	**High**	**low**
Voltage gain	**150**	**500**	**unity**
Power gain	**Medium**	**High**	**medium**
PHASE	**In phase**	**180 phase shift**	**In phase**

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.		**Attempt any TWO of the following :**	**12- Total Marks**
	a)	**(i) Compare between analog and digital IC.** **(ii) Find the value of resistor from the given color code.** **(1) Brown, Black, Red, Silver** **(2) Orange, Red, Brown, Gold**	**6M**

	Ans:	(i) Compare between analog and digital IC. <table><tr><th>Items</th><th>Analog IC</th><th>Digital IC</th></tr><tr><td>Signal Characteristics</td><td>Continuous, such as light, sound, speed, temperature, etc.</td><td>Discrete, 0 and 1.</td></tr><tr><td>Technological Complexity</td><td>High entry barrier with 10~15 years learning curve</td><td>Relying on Computer Aided Design (CAD) tools with 3~5 year learning curve</td></tr><tr><td>Product Accreditation</td><td>More than 1 year</td><td>3~6 months</td></tr><tr><td>Substitution</td><td>Low</td><td>High</td></tr><tr><td>Product Portfolio</td><td>Low volume, High variety</td><td>High volume, Low variety</td></tr><tr><td>Applications</td><td>Power management, Audio amplification, Signal transformation and monitoring</td><td>Logic computation, Control, Digital signal coding/decoding</td></tr><tr><td>Price</td><td>Stable</td><td>Volatile</td></tr></table> (ii) Find the value of resistor from the given color code. (1) Brown, Black, Red, Silver (2) Orange, Red, Brown, Gold 1) $10 * 10^2$=10*100=1000 ohm=1kohm,10% 2) $32 * 10^1$= 320 ohm,5%	**(i) 1/2 mark each point** **(ii) 1 mark each calculation**
	b)	**Draw the circuit diagram and describe the working principle of full wave bridge rectifier. Draw its waveforms.**	**6M**
	Ans:	During the first half cycle During the first half cycle of the input voltage, the upper end of the transformer secondary winding is positive with respect to the lower end. Thus during the first half cycle diodes D1 and D_3 are forward biased and current flows through arm AB, enters the load resistance R_L, and returns back flowing through arm DC. During this half of each input cycle, the diodes D_2 and D_4 are reverse biased and current is not allowed to flow in arms AD and BC. The flow of current is indicated by solid arrows in the figure above. We have developed another diagram below to help you understand the current flow quickly. See the diagram below – the green arrows indicate the beginning of current flow from the source (transformer secondary) to the load resistance. The red arrows indicate the return path of current from load resistance to the source, thus completing the circuit.	**Diagram - 2marks, working - 2marks, waveform- 2marks**

		During the second half cycle During the second half cycle of the input voltage, the lower end of the transformer secondary winding is positive with respect to the upper end. Thus diodes D_2 andD_4 become forward biased and current flows through arm CB, enters the load resistance R_L, and returns back to the source flowing through arm DA. The flow of current has been shown by dotted arrows in the figure. Thus the direction of flow of current through the load resistance R_L remains the same during both half cycles of the input supply voltage. See the diagram below – the green arrows indicate the beginning of current flow from the source (transformer secondary) to the load resistance. The red arrows indicate the return path of current from load resistance to the source, thus completing the circuit.	

		 Input Voltage Waveform   Rectified Output Voltage/Current Waveforms BRIDGE RECTIFIER www.CircuitsToday.com OR Description in simple At positive half cycle the Diode D1 and D3 will be forward biased and current path will be Terminal A, Diode D1,Terminal B, Resistor RL, terminal D, diode D3, and terminal C back to transformer and output will positive half cycle. At the negative half cycle diode D2 and D4	

		will be forward biased current path will be Terminal C, Diode D2,Terminal B, Resistor RL, terminal D, diode D4, and terminal A back to transformer and output will positive half cycle.	
	c)	**Draw the construction of BJT (NPN) and explain its working principle. State and explain different operating regions.**	**6M**
	Ans:	Construction of BJT (NPN):  Working of NPN Transistor The circuit diagram of the NPN transistor is shown in the figure below. The forward biased is applied across the emitter-base junction, and the reversed biased is applied across the collector-base junction. The forward biased voltage V_{EB} is small as compared to the reverse bias voltage V_{CB}.  The emitter of the NPN transistor is heavily doped. When the forward bias is applied across the emitter, the majority charge carriers move towards the base. This causes the emitter	**Construction diag.-1mark,working-2 marks,** **opoerating region explanation-2marks, state region-1 mark**

current I_E. The electrons enter into the P-type material and combine with the holes.

The base of the NPN transistor is lightly doped. Due to which only a few electrons are combined and remaining constitutes the base current I_B. This base current enters into the collector region. The reversed bias potential of the collector region applies the high attractive force on the electrons reaching collector junction. Thus attract or collect the electrons at the collector.

The whole of the emitter current is entered into the base. Thus, we can say that the emitter current is the sum of the collector or the base current.

Active region.

The region between cut off and saturation is known as *active region*. In the active region, collector-base junction remains reverse biased while base-emitter junction remains forward biased. Consequently, the transistor will function normally in this region.

Saturation.
The point where the load line intersects the $IB = IB(sat)$ curve is called *saturation*. At this point, the base current is maximum and so is the collector current. At saturation, collector-base junction no longer remains reverse biased and normal transistor action is lost.

$$I_{C\,(sat)} \simeq \frac{V_{CC}}{R_C}\,; \quad V_{CE} = V_{CE(sat)} = V_{knee}$$

If base current is greater than $IB(sat)$, then collector current cannot increase because collector-base junction is no longer reverse-biased.
OR
Both junction are forward bias and ouput current change with output biasing voltage transistor in saturation region. In this region transistor act as closed switch.

Cut off.
The point where the load line intersects the $IB = 0$ curve is known as*cut off*. At this point, $IB = 0$ and only small collector current (*i.e.* collector leakage current *ICEO*) exists. At cut off, the base-emitter junction no longer remains forward biased and normal transistor action is lost. The collector-emitter voltage is nearly equal to *VCC i.e. VCE* (*cut off*) = *VCC*

OR

		Both junction are reversed bias and ouput current is Zero with input current is Zero transistor in cut off. In this region transistor act as open switch	