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 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.

Q1. Attempt any ten **20M**

a) State Faraday's 1st Law of Electromagnetic induction. **2M**

Ans: The Faraday's 1st Law state that when the magnetic flux linking with the coil (or conductor) changes, an e.m.f. is induced in the coil (or conductor) or when a conductor cuts the magnetic flux, an e.m.f. is induced in the conductor.

b) Define Q factor. **2M**

Ans: The ability of an inductor to store energy as compared to the dissipation of energy within the inductor is called Quality or Q factor (Figure of merit)

$$Q = \frac{\text{Energy stored}}{\text{Energy dissipated}}$$

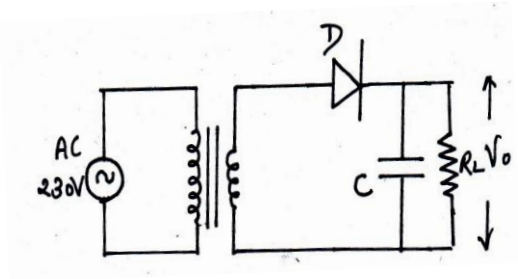
c) State the factors affecting the capacitor.

Ans: **2M**

i. Type of Dielectric material
ii. Area of the two parallel plate
iii. Distance between the two conductor plates

d) Draw the circuit diagram of half wave rectifier with capacitor shunt filter

Ans: **2M**



e) State the necessity of the filter in electronic circuits. **2M**

Ans: The output of rectifier contains D.C. component as well as an A.C. component (ripple). The presence of an A.C. component is most undesirable and therefore must be removed from the rectifier output. This can be done by a circuit called filter.

f) State the value of voltage across short circuit and value of current flowing through open circuit. **2M**

Ans: The voltage across shunt circuit = 0 V

The current flowing through open circuit = 0 A.

g) State the Kirchhoff's voltage law along with its formula. **2M**

Ans: Kirchhoff's voltage law states that in any closed loop the algebraic sum of the voltage drop in each of the conductors and algebraic sum of the emfs in that loop is zero.

$\sum I.R + \sum emf = 0$

h) A resistance of 10Ω is connected parallel with 8Ω. Is the current through the combination is 10A, calculate current through 10Ω resistance. **2M**

Ans: By current division formula

$I_{R10} = I_T * \frac{8}{8 + 10}$

$= 10 * \frac{8}{18}$

$I_{R10} = 4.44A$

Therefore current in 10Ω resistor = 4.44A

i) Describe Avalanche breakdown. **2M**

Ans: Avalanche breakdown:

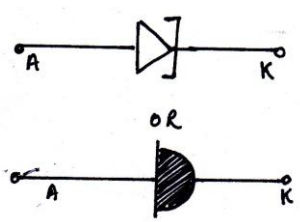
- The increased reverse voltage increases the amount of energy impaled to minority carriers, as they diffuse across the function.
- As the reverse voltage is increased further the minority carriers acquire a large amount of energy.
- When these carriers collide with S_i aloms,(or) aloms, within the crystal structure they impact sufficient energy to break a covalent bond and generate additional carriers (electron hole pairs).
- These additional carriers pick up energy from the applied voltage and generate more carriers, and reverse current increased rapidly.
- This cumulative process of carrier generation (or multiplication) is known as Avalanche breakdown.

j) Draw the symbol of

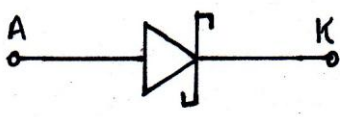
i. Schottky diode **1M**

ii. Tunnel diode **1M**

Ans: **Tunnel diode** **Tunnel diode**



TUNNEL DIODE



SCHOTTKY DIODE

k) State the condition for differentiator with reference to RC differentiator with neat circuit diagram. 2M

Ans: when an RC circuit fulfills the following two condition then the voltage appears across R will be the derivative of the input,

i. The value of X_c should be 10 times or more as compared to the value of resistor (R)

i.e. $X_C >> 10.R$

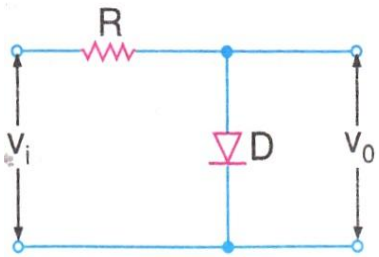
ii. The time constant ($\tau = RC$) should be much smaller than the time period of the input signal.

i.e. $RC << T$

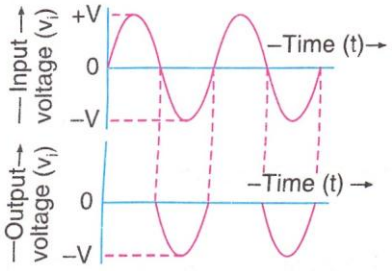
Where T = time period of input signal.

l) Draw the circuit diagram of shunt positive clipper with Input and Output waveform.

Ans: (circuit diagram 1 mark, waveform 1 mark)



(a)Shunt positive clipper

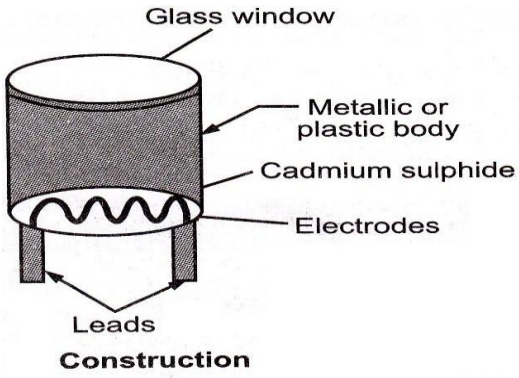


(*b*) Input and output waveforms.

Q2. Attempt any four. **16M**

a) Draw and describe the construction of LDR. List its two applications.

Ans: Diagram **2M**



Construction

Construction: **1M**

- The photo resistor (or LDR) are manufacture from photo-conductive semi-conductor materials such as cadmium sulphide (CdS), cadmium selenide (CdSe) and lead sulphide (PbS)
- These resistors have a ceramic substrate, over which a layer of cadmium sulphide (CdS) is deposited in zig-zag form to increase the length. Hence it increases the resistance value.
- The basic construction of photo resistor (or LDR) is shown in above figure.
- Depending on thickness, surface area and length of the layer, the resistance value changes. The electrodes are formed by evaporating metal in vacuum.
- The leads are connected and put in plastic case. These are available in the form of disk with wire lead ends on one side.
- The resistance of photo resistors may be several mega ohms in total darkness and less than 100Ω , when well illuminated

Applications of LDR (any two) **1M**

i. It is used for automatic contrast and brightness control in television receivers.
ii. Used as proximity switch.
iii. Used in the optical coding
iv. Used in the smoke detectors.
v. Used in the street light control circuit.

b) List specifications of Resistor. State any two.

Ans: Specification of a resistor are (any four) **2M**

i. Resistance value
ii. Tolerance
iii. Power rating
iv. Maximum operating temperature
v. Maximum operating voltage.
vi. Frequency range.

State any two of the following: **2M**

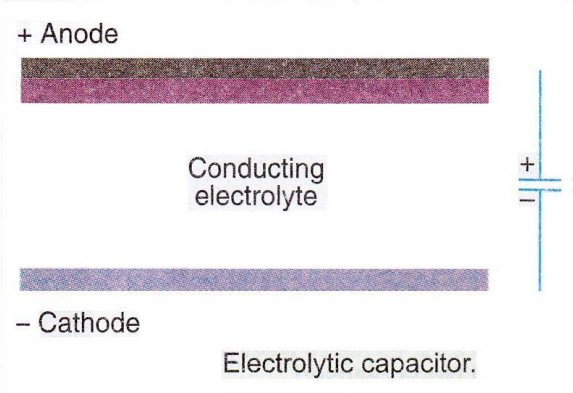
i. Resistance value: the resistivity of material is defined as the resistance of the piece of that material which is 1 meter long and of unit cross-sectional area.

ii. Tolerance: the Tolerance is defined as the accuracy to which the value of a resistor can be made or selected. The various tolerances (i.e. 2%, 5%, 10% or 20%) are available and they depend upon the type of resistor.

iii. Power rating: the maximum amount of heat dissipated by a resistor at maximum specified (operating) temperature without any damage to resistor is called power rating of a resistor. It is expressed in Watt (W) at specified temperature.

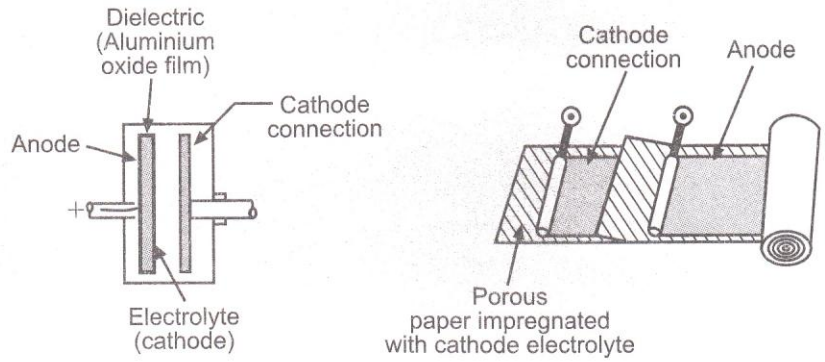
c) Draw the constructional diagram of electrolytic capacitor, state its working.

Ans: Diagram **2M**



Electrolytic capacitor.

OR



Working: **2M**

- When a voltage of correct polarity is applied to a capacitor, a very thin insulating layer of an oxygen atom forms between the anode and the oxide layer.
- A reversal of polarity removes the insulating layer, thereby allowing very high currents. Thus electrolytic capacitors are known as polarized capacitors.
- They must be connected in a circuit according to the 'plus' (+) and 'minus' (-) marking on the body of a capacitor.
- If the capacitor is connected with a reverse polarity, it will act as a short circuit and get overheated, due to excessive leakage current, and it can explode also.

d) Define:

i. Capacitive reactance

ii. Frequency characteristic

Ans:

i. Capacitive reactance: - **2M**

The resistance offered by the capacitor is called as capacitive reactance

$$X_C = \frac{1}{2\pi fc}$$

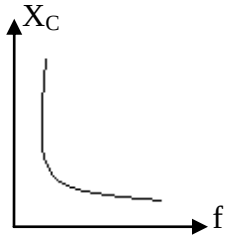
The rate of change of the voltage which is proportional to the applied voltage is called the reactance of a capacitor.

ii. Frequency characteristic: - **2M**

It is the graph between the frequencies of the applied A.C. supply verses the overall gain of the circuit.

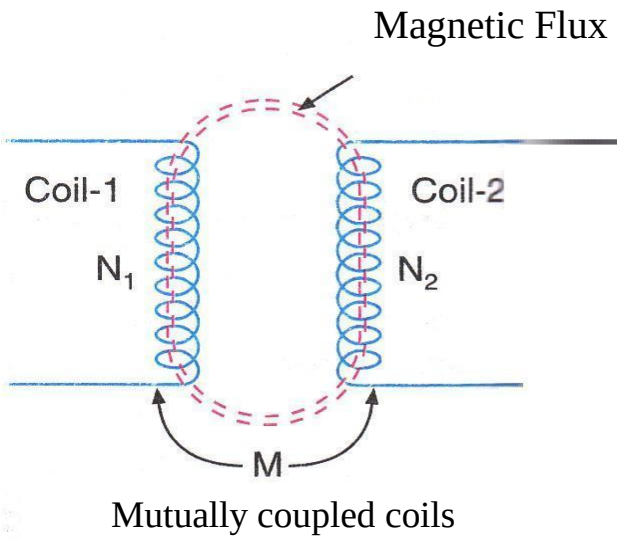
OR

Frequency characteristic is the effect of frequency on capacitive reactance. Capacitive reactance is inversely proportional to the applied frequency. As frequency increases capacitive reactance decreases.



e) Describe mutual inductance with suitable diagram and derivation.

Ans:



Mutually coupled coils

Mutual inductance:

- If the current in one circuit produces flux in another coil, then the parameter is calles mutual inductance. If the e.m.f. sets up in the neighbouring coil, then it is called as mutual inductance.
- The property of a coil to induce e.m.f. in another coil, when the current in the coil is changed and the flux produced by the first coil is called mutual inductance. Its unit is Henry i.e.H

$$M = \frac{\mu_0 \mu_r A N_1 N_2}{l} \quad \textbf{OR} \quad M = k\sqrt{L_1 L_2}$$

- When two coils 1 and 2 having turns N_1 and N_2 respectively are placed together, all the flux produced by the coil 1 A does not link with other coil 2. Only a certain proportional, say k, of flux produced by the coil 1 links with the other 2, k being less than unity, k is called coefficient of coupling. The expression for coefficient of coupling is as under :

$$k = \frac{M}{\sqrt{L_1 L_2}}$$

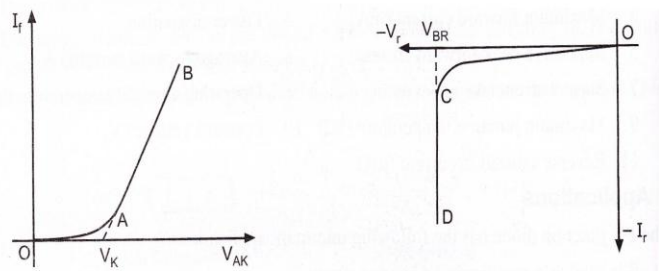
Where k = coefficient of coupling

L_1 = self-induction of coil 1

L_2 = self-induction of coil 2

f) Draw and describe V-I characteristics of PN junction (diagram 2M, explanation 2M)

Ans: The V-I characteristics is a graph between the voltage applied across the terminals of PN junction and the current flowing through it.



(a) Forward characteristics (b) Reverse characteristics

V-I characteristics of a PN junction diode

Forward characteristics

A graph between the forward voltage across the terminals of junction diode and the current flowing through it is known as forward characteristic.

- A forward characteristics of a PN junction diode is as shown in figure (a)
- It is observed that the PN junction conducts the forward current only after the cut-in(i.e. knee) voltage(0.3V for Ge and 0.7V for Si).

Reverse characteristics

- A graph plotted between the reverse voltage across the terminals of a PN junction diode and the current flowing through it is known as a Reverse characteristics.
- A reverse characteristics of a PN junction diode is as shown in figure (b). It is observed that the flow of reverse current is very small till breakdown voltage V_{BR} reached.

Q3. Attempt any four **16M**

a) List applications of Zener diode.(any 4 applications) **1 mark each**

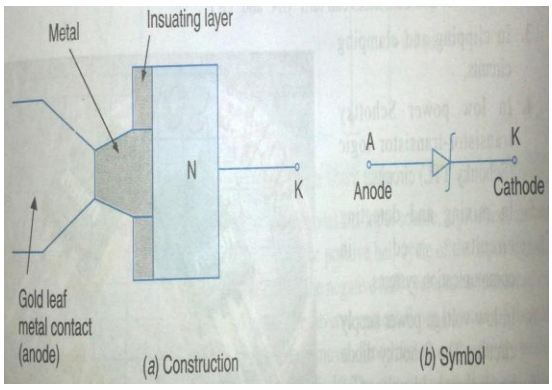
Ans:

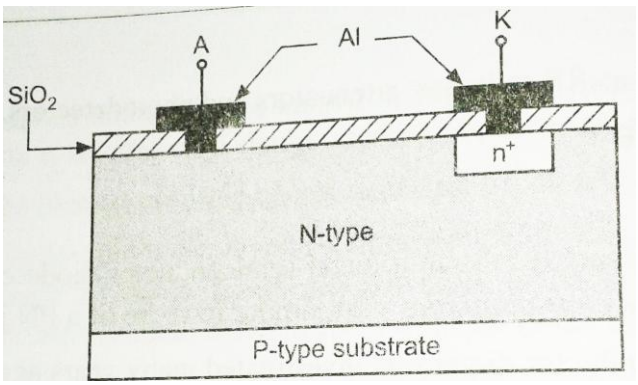
- As a voltage regulator in regulated power supply
- Pulse amplifier
- As a fixed reference voltage in transistor biasing circuits
- As a peak clipper or limiter in wave shaping circuits
- In the protection circuit for MOSFET
- For meter protection against damage from accidental applications

b) Describe the construction of Schottky diode with neat sketch. List two applications

Ans:

- Construction of Schottky diode:- OR **2M**





Description: **1M**

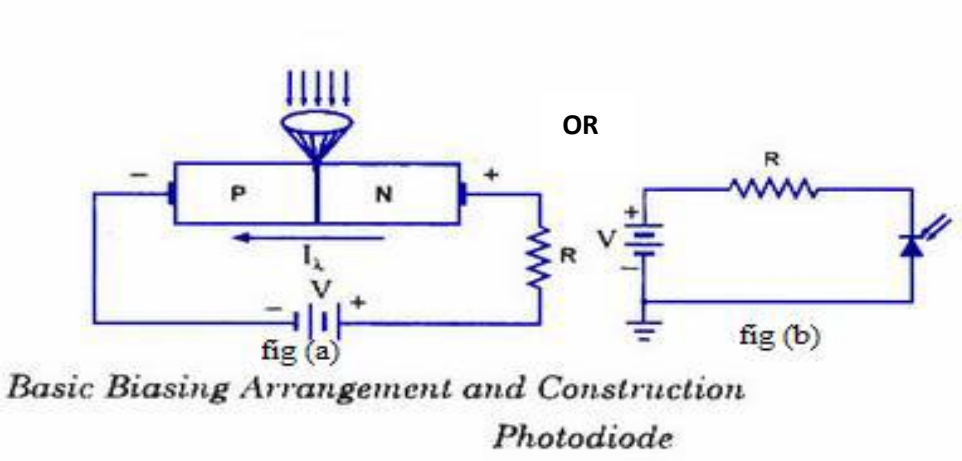
- Fig (b) shows the schematic symbol of Schottky diode. The line at the end of the arrow looks like the letter 'S'
- It is formed by joining a doped semiconductor region (usually N-type) with a metal such as gold, silver or platinum.
- Thus in a Schottky diode, there is a metal-to-semiconductor junction rather than a simple P-N junction as shown in fig above.
- A Schottky diode is also called a hot carrier diode or a Schottky barrier diode

Applications:- (any 2 applications) **½ mark each**

- To rectify very high frequency signals.
- As a switching device in digital computer.
- In clipping and clamping circuits.
- Mixers and detectors in communications equipments.

c) Describe the operating principle of photodiode with neat sketch

Neat sketch: - **2M**



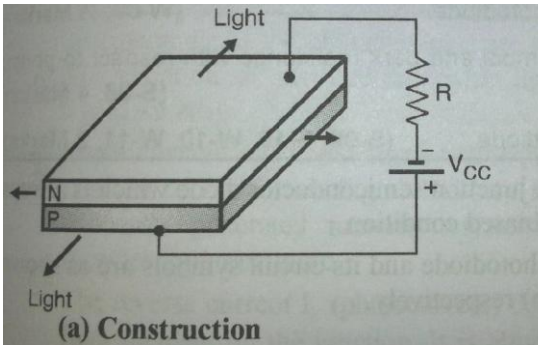
Basic Biasing Arrangement and Construction Photodiode

Principle: **2M**

- A photo-diode is a reverse biased silicon or germanium PN junction in which reverse current increases when the junction is exposed to light.
- The reverse current in a photo-diode is directly proportional to the intensity of light falling on its PN junction.
- A photodiode differs from a rectifier diode in that when its PN junction is exposed to light, the reverse current increases with the increase in light intensity and vice versa.
- When light (Photon) falls on the PN junction energy is imparted by the photons to the atoms in the junction.
- This will create more free electrons (and more holes).
- These additional free electrons will increase the reverse current. As the intensity of light incident on the PN junction increases the reverse current also increases.

d) Draw and describe the working principle of IRLED

Diagram **2M**



Infra Red Light Emitting Diode (IR-LED):

Fig (a) shows the construction of IR-LED and fig (b) shows its characteristics.

This type of LED emits light in the infrared region of electromagnetic spectrum.

Principle **2M**

- The IR-LED is a PN junction diode. It is of Gallium Arsenide (Ga As) and is operated in the forward biased condition.
- When the forward voltage is applied, the electrons from the N-side will recombine with the holes on P-side in the recombination region between P and N regions.
- During every recombination some of energy is released which is radiated in the form of Infra-Red light

e) Draw π- filter and state its working

Ans:

Working **2M**

The combination of two shunt capacitors and a series inductor connected in between these shunt capacitors, a CLC filter or a capacitor input filter. It is also called a π- type filter. it is used wherever a low O/P current and a high d.c O/P voltage is required

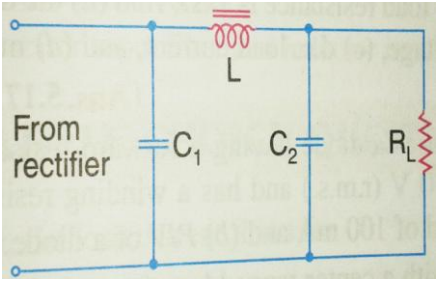
It consist of a filter capacitor C_1 connected across the rectifier output, a choke L in series and another filter capacitor C_2 connected across the load resistor $R_{L.}$

Capacitor C_1:- it offers a low reactance to a.c component of rectifier output. But it offers infinite resistance to d.c component. Therefore the capacitor C_1 bypasses an appreciable amount of a.c. component to the ground, while d.c component moves towards L.

Inductor L:- It offers a high reactance to a.c. components of the rectifier output but zero resistance to the d.c. component. Therefore it allows d.c component to pass through it and blocks the a.c component, which could not be bypassed by the capacitor C_1.

Capacitor C_2:- It's function is similar to Capacitor C_1. It bypasses the a.c component of rectifier output which could not be blocked by an inductor L. as a result only the d.c component is available at the filter's output.

Diagram:- **2M**



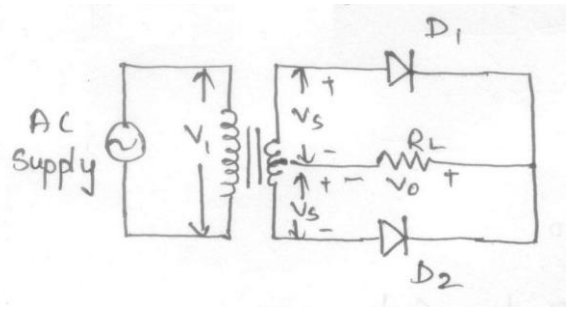
f) Compare Half wave rectifier with full wave rectifier on the basis of number of diodes, efficiency, TUF(any one type of full wave rectifier can be considered) 4M

Parameters	Half wave rectifier	Full wave rectifier	
		Center tapped	Bridge
Number of diodes	1	2	4
Efficiency	40.6%	81.2%	81.2%
TUF	0.287	0.693	0.812

Q4. Attempt any four **16M**

a) Draw and describe full wave centre tapped rectifier. Draw its input and output waveform.

Ans: Circuit diagram: 2M



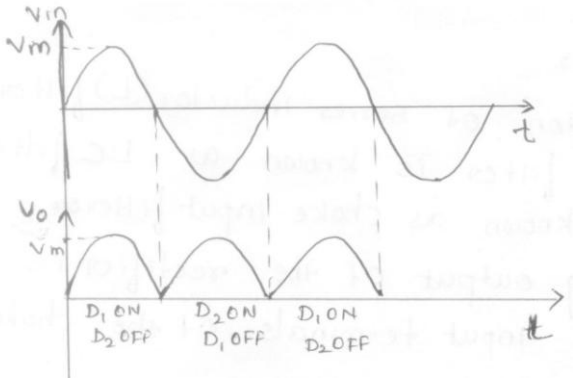
Explanation 1M

i. Fig. shows the circuit of a centre tapped full wave rectifier, the circuit uses two diodes which are connected to the centre tapped secondary winding of the transformer. The input signal is applied to the primary winding of the transformer. The centre tap on the secondary winding of a transformer is usually taken as the ground or zero voltage reference point

ii. During positive half cycle of input signal diode D_1 forward biased and D_2 reverse biased.

iii. During negative half cycle of input signal diode D_1 reverse biased and D_2 forward biased.

Input and output waveforms. **1M**



b) Using colour code, write colour code for following resistor:

i. 100Ω±5%

ii. 4K7±10%

Ans: **2M each**

i. 100Ω±5%

$10*10^1 \pm 5\%$

Brown, Black, Brown, Gold

iii. 4K7±10%

$4.7 * 10^3 \pm 10\%$

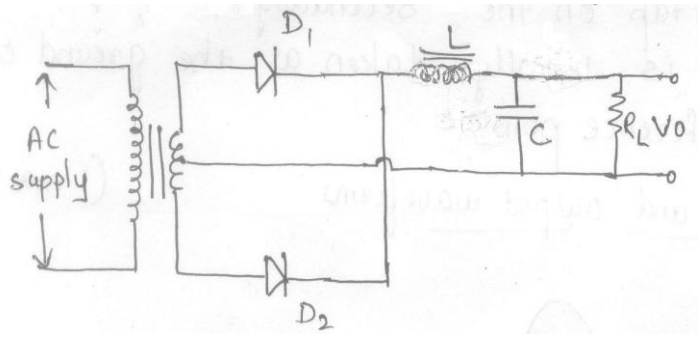
$47 * 10^2 \pm 10\%$

Yellow, Violet, Red, Silver.

c) Draw the circuit diagram of LC filter and state its working.

Ans: circuit diagram: **2M**

[Note: Any type of rectifier can be used while explaining LC filter]



Working: **2M**

- The combination of series inductor (L) filter on shunt capacitor (C) filter is known as LC filter.
- This filter is also known as the rectifier is applied across the input terminals of the choke input filter.
- The pulsating output of the rectifier contains AC as well as DC component of current. The choke L passes the DC component from the rectifier because its DC resistance R is very small.
- It opposes the AC component capacitor C bypasses AC component that presents at the output of inductor L but prevents DC component to flow through it.
- Therefore only DC component reaches to the load resistor R_L.

d) An AC supply of 230V is applied to half wave rectifier circuit. A transformer turns ratio is 10 : 1. Find

i. Output DC voltage.

ii. Peak inverse voltage

Ans: Given V_1 = 230 Volts

$$\frac{N_2}{N_1} = \frac{V_2}{V_1}$$ **½ M**

i. We know that the secondary voltage

$$V_2 = V_1 \times \frac{N_2}{N_1} = 230 \times \frac{1}{10} = 23 volts$$ **1M**

Maximum value of secondary voltage:

$$V_m = \sqrt{2} \times V_2 = \sqrt{2} \times 23 = 32.5 \, volts$$ **1M**

Therefore DC voltage $V_{dc} = \frac{V_m}{\pi} = \frac{32.5}{3.14}$ = 10.3V **1M**

ii. PIV of a diode

PIV = V_m = 32.5 volts. **½ M**

e) Compare LED and LASER (Any 4 points)

Sr. no.	LED	LASER
1.	LED means Light Emitting diode	LASER means light Amplification By Stimulated Emission Of Radiation
2.	LED's are small in size	Lasers are bigger in size
3.	Response is slower	Response is faster
4.	Wide range of wavelength is available	Small range of wavelength is available
5.	Cost is less	Cost is higher.

[Note: any additional points will also be considered]

f) Explain static and dynamic resistance of PN junction diode.

Ans:

Static resistance: - **2M**

A diode has a definite value of resistance when forward biased; this resistance is known as the d.c or static forward resistance. It is given by the ratio of the d.c. voltage across the diode to the d.c. current flowing through it.

Mathematically it is expressed as

$$R_f = \frac{V_f}{I_f}$$

Dynamic resistance: **2M**

The resistance offered by the diode to an a.c. signal is called its dynamic or a.c. resistance.

$$r_{ac} = \frac{\Delta V_f}{\Delta I_f}$$

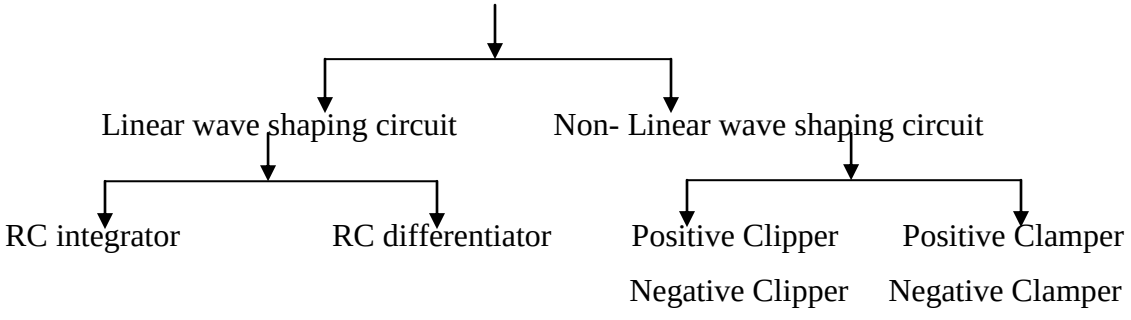
Q.5 ATTEMPT ANY FOUR **16M**

a) State the necessity of wave shaping circuit. Classify different wave shaping circuit.

Ans: Necessity of wave shaping circuit:- **2 marks ½ marks each**

- To limit the voltage level of the waveform to some preset value
- To shift the waveform to a particular voltage level
- To generate one wave from the other.
- To cut the negative and positive portion of the waveform

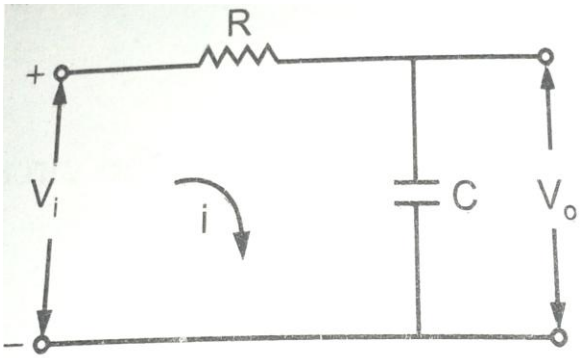
Classification of wave shaping circuits:-Wave shaping circuits **2M**

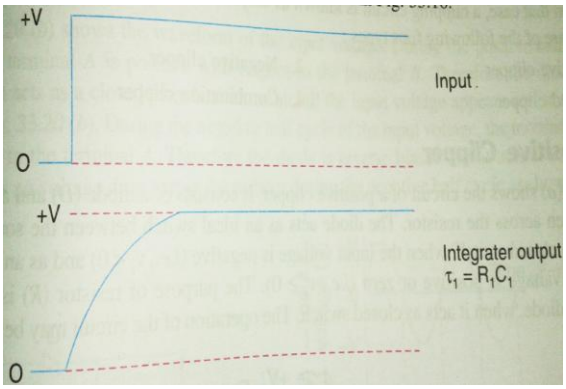


b) Describe the working principle of RC integrator with neat sketch. Draw output waveform if input is step input

Ans:

Circuit diagram:- **1M** Waveform **1M**





Working principle:- **2M**

In integrator, as the frequency increases the reactance of the capacitor decreases. Hence the lower frequency passes through the circuit easily but opposes the high frequencies. Therefore integrating circuit is also called as low pass filter.

The voltage drop across C will be small as compared to that of voltage drop across R. hence it may be assumed that i/p V_i will be across R. the current ' i ' is given as

$i = V_{i/R}$

Output voltage across C is Vo

$Vo = 1 / C \int i.\, dt$

$= 1 / C \int Vi / R\, dt$

$= 1 / RC \int V\, i.\, dt$

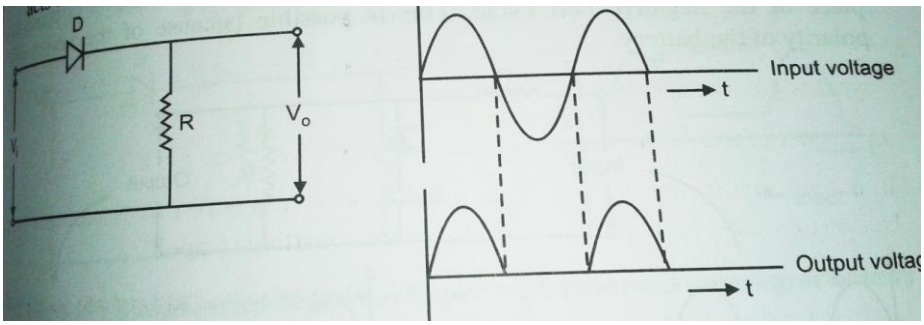
Where R and C are constant

Hence V_O is directly proportional to integration of input signal. For good integration the time Constant of the circuit must be greater than or equal to 10 times the period of the input signal.

c) Draw and describe working of negative series clipper with circuit diagram and I/P and O/P waveform

Ans:

Circuit diagram:- **(1 mark)** I/P & O/P wave form:- **(1 mark)**



Working:- **2M**

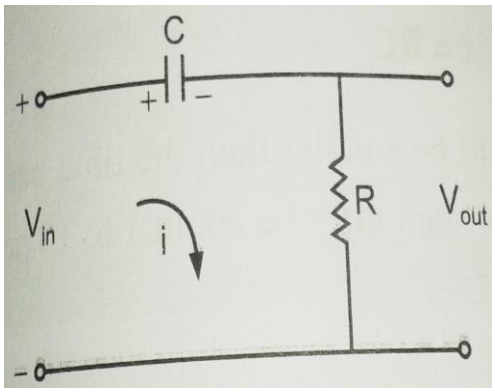
It is called as negative series clipper because diode D is connected in series with load.

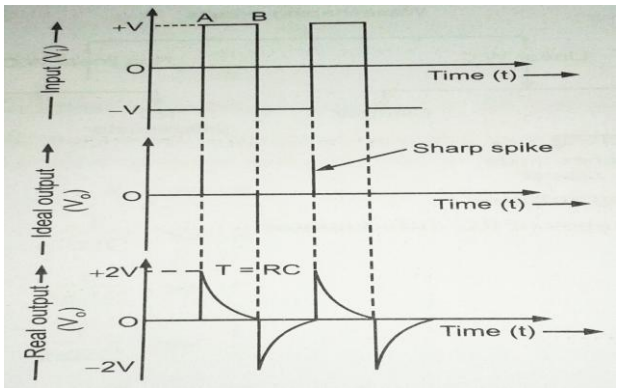
During positive half cycle diode is forward biased and o/p voltage is equal to positive half cycle of i/p.

During negative half cycle diode is reverse biased and o/p voltage is equal to zero. thus negative cycle gets clipped of in the negative series clipper.

d) Draw RC differentiator with neat sketch. Draw the O/P waveform for square wave I/P

Ans: Circuit diagram **2M** I/P and O/P waveform **2M**



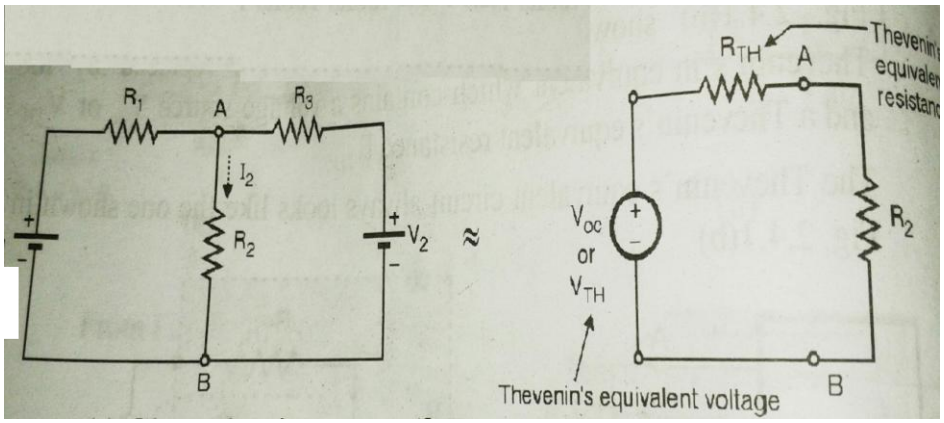


e) State Thevenin's theorem with suitable example

Ans: Statement of Thevenin's theorem:- **2M**

It states that any two terminal linear network containing one or more energy sources and impedances can be replaced by an equivalent circuit consisting of an ideal voltage source V_{TH} in series with a resistance R_{TH}.

Example:- **2M**



V1

The voltage V_{OC} (open circuit voltage)or V_{TH} (thevenin's equivalent voltage) is obtained by removing the resistance R_2 and measure the open circuit voltage between points A & B.

$$Voc = V_{AB} = V_1 - I R_1 - I R_3 - V_2 = 0$$

R_{TH} can be find out by removing load R_2 and all the voltage / current sources are replaced by their internal resistances.

$$R_{TH} = R_1 * R_2 / R_1 + R_2$$

Finally calculate the load current I_2 through load resistor R_2 using formula

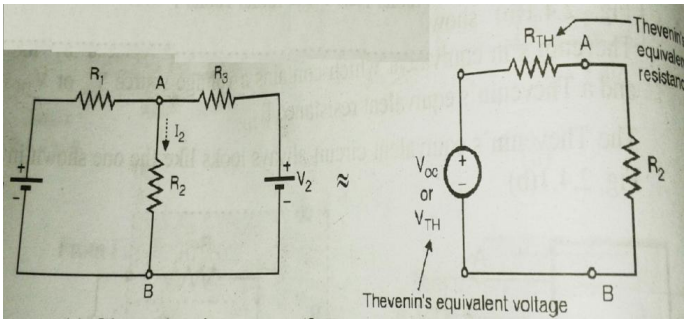
$$I_2 = V_{OC} / R_{TH} + R_2$$

f) State maximum power transfer theorem with suitable example

Ans: Statement maximum power transfer theorem:- **2M**

It states that for a given linear network represented by a thevenin's equivalent circuit, the maximum power will be transferred by the network to the resistive load, when the load resistance is equal to the thevenin's resistance

Example: - *[Note: any example should be given marks]* **2M**



The voltage V_{OC} (open circuit voltage) or V_{TH} (thevenin's equivalent voltage) is obtained by removing the resistance R_2 and measure the open circuit voltage between points A & B.

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$$R_{TH} = R_1 * R_2 / R_1 + R_2$$

Finally calculate the load current I_2 through load resistor R_2 using formula

$$I_2 = V_{OC} / R_{TH} + R_2$$

For maximum power transfer to the load the R_{TH} should be equal to R_L

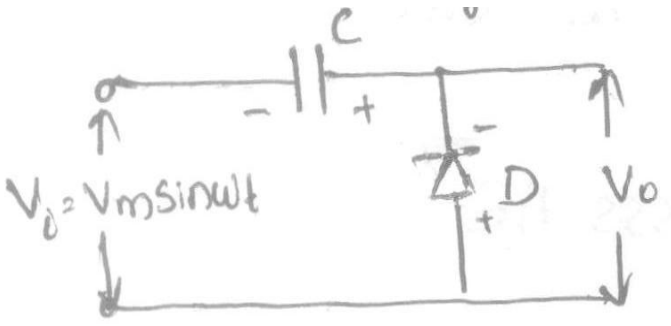
i.e $R_{TH} = R_L$

$$P_{L(max)} = V_{oc}^2 / 4*R_L$$

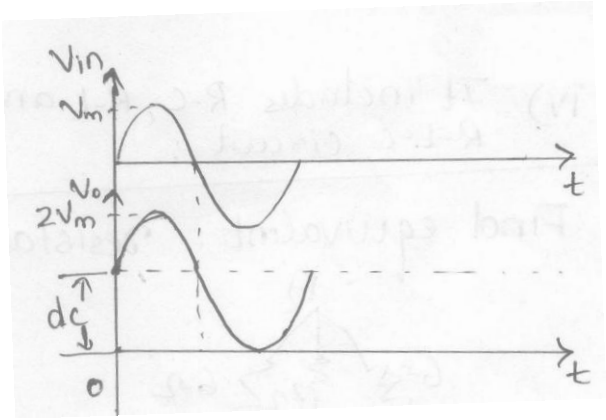
Q6. Attempt any four:

a) Draw circuit diagram for negative and positive voltage clamping circuit with I/P and O/P waveforms.

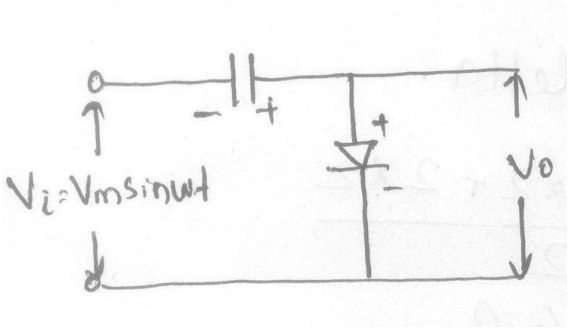
Ans: Positive clamping circuit: **1M**



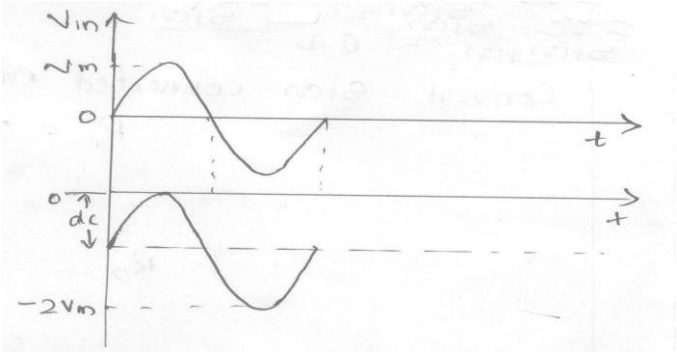
Waveform: **1M**



Negative clamping circuit: **1M**



Waveform: **1M**



b) Compare linear and non-linear wave shaping circuits (any 4 points)

Ans: *[Note: any additional points can be considered]*

Sr. no.	Linear wave shaping circuit	Non-linear wave shaping circuit
1.	The process of altering non-sinusoidal waveform by passing through network is called linear wave shaping.	The process of producing non-sinusoidal output waves from sinusoidal input is called non-linear wave shaping
2.	It involves passage of signal through linear system	It involves passage of signal through non-linear system
3.	Example: integration, differentiator.	Example: clipper, clapper.
4.	It includes R-C, R_L and R-L-C circuit.	It includes diode, zener diode.

c) Find equivalent resistance across point AB (fig. a)

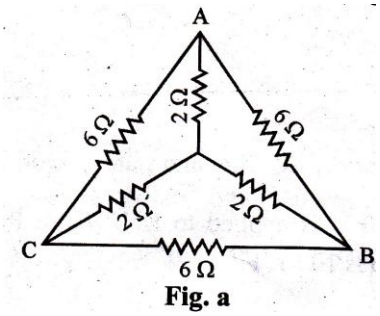


Fig. a

Ans:

Convert star connected network to delta.

$R_1 = \frac{2*2+2*2+2*2}{2}$

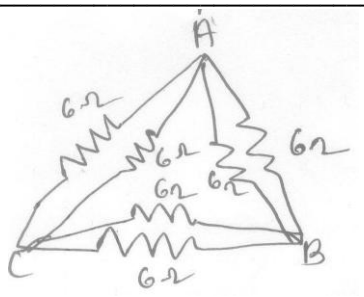
$= \frac{12}{2}$

$= 6\Omega$

$R_2 = \frac{2*2+2*2+2*2}{2} = 6\Omega$

$R_3 = \frac{2*2+2*2+2*2}{2} = 6\Omega$

Circuit diagram after converting star to delta



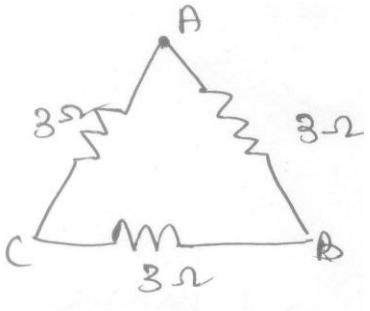
Here all three resistors are connected parallel with the delta network.

So, equivalent to resistance

$$R_q = \frac{6 * 6}{6 + 6} \text{ (in all braches)}$$

$$= \frac{36}{12}$$

$$= 3\Omega$$



$$R_{AB} = 3 * \frac{3+3}{3+3+3}$$

$$= \frac{3 * 6}{9}$$

$$= \frac{18}{9}$$

$$= 2\Omega$$

d) Determine current I_L for network using Theveninis theorem (fig. b)

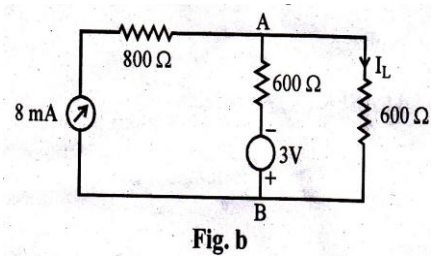
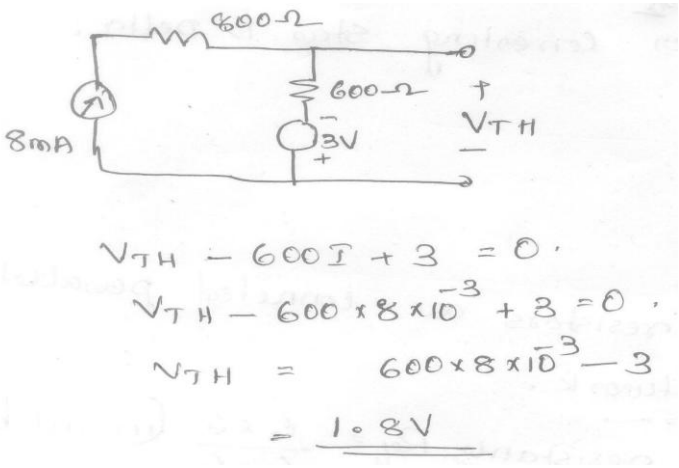


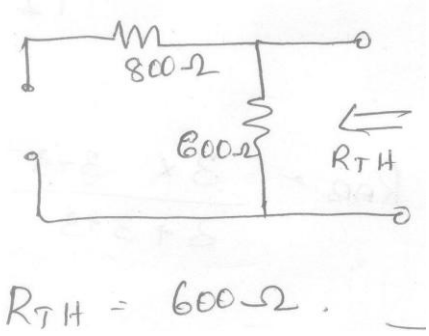
Fig. b

Ans: step 1

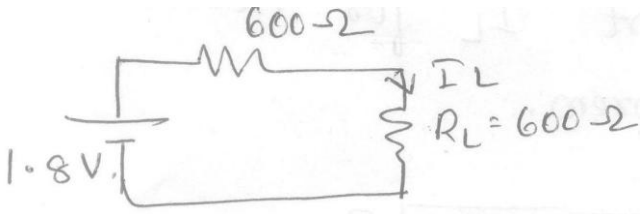
Remove load resistor R_L and find V_{TH} **2M**



To find R_{TH}. Remove sources: **1M**



Thevenin equivalent circuit **½ M**



$I_L = \frac{1.8}{600 + 600}$

= .0015A **OR** = 1.5 mA **½ M**

e) Find the current in different branches using Nodal Analysis (fig. c)

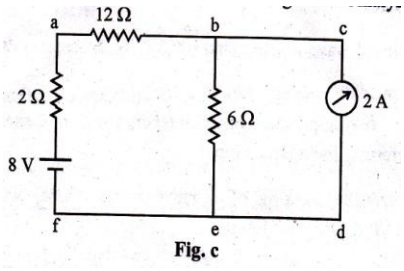
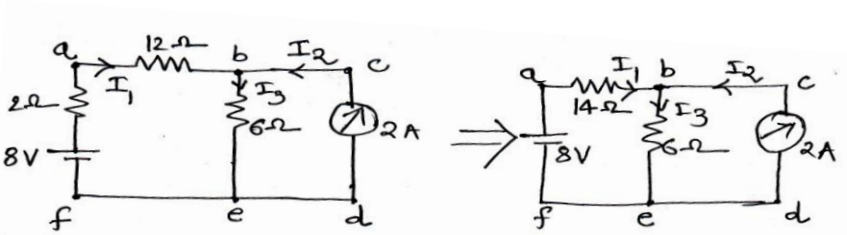


Fig. c

Ans:



Apply KCL at Node 'b'

$I_1 + I_2 = I_3$

$\frac{8 - V_b}{14} + 2 = \frac{V_b}{6}$

$\frac{8}{14} - \frac{V_b}{14} + 2 = \frac{V_b}{6}$

$\frac{8}{14} + 2 = \frac{V_b}{6} + \frac{V_b}{14}$

$0.5714 + 2 = V_b \left[\frac{1}{6} + \frac{1}{14}\right]$

$= V_b [0.166 + 0.0714]$

$2.5714 = V_b [0.237]$

$\therefore V_b = \frac{2.5714}{0.237} = 10.849$ V

2 marks

$I_1 = \frac{8 - 10.849}{14} = -0.283$ amp ——— 1 mark

$I_3 = \frac{10.849}{6} = 1.808$ Amp ——— 1 mark.

$I_2 = 2$ Amp.

f) Define: i) Mesh

ii) Sign conversion.

iii) Potential rise.

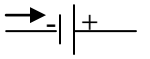
iv) Potential drop.

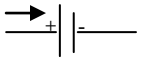
Ans:

i) Mesh: - Mesh is a closed path in a circuit or a network. **1M**

[Note: any relevant answer should be given marks.]

ii) Sign conversion (convention): -sign of EMF A rise in voltage is given a positive sign and a fall in voltage is given a negative sign. **1M**

Rise in voltage  = +V

Fall in voltage  = -V

Sign of I_R drop: if we are moving in the same direction of current, I_R drop will be negative.

If we are moving in the opposite direction of current, I_R will be positive.

iii) Potential rise: - if we go from negative terminal to positive terminal, it is potential rise.**1M**

iv) Potential drop: - if we move from positive terminal to negative terminal, it is potential drop i.e. (fall in voltage) **1M**