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Subject :- Electronic Devices & circuits.

Q1 :-

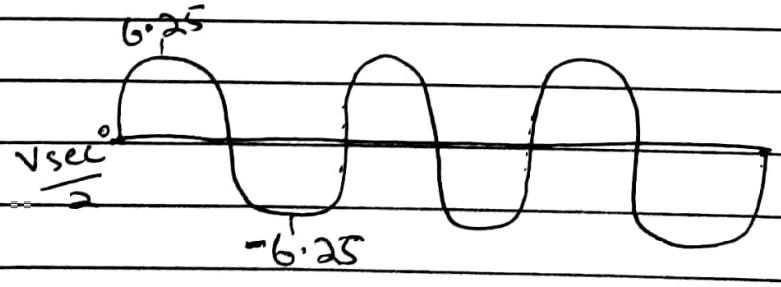
a) It is a center tapped full wave rectifier

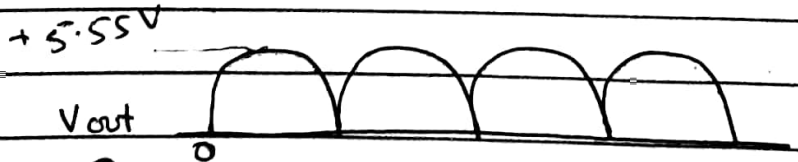
b) Total peak secondary voltage.

$V_p(sec) = nV_p(p_{ri}) = 0.25(50) = 12.50V$

$V_p(sec) = 12.5V$

c) Peak of Half of each secondary voltage.





$6.25 - 0.7 = 5.55V$

So Peak to Peak voltage is 6.25 and if we subtract the drop then it equals to +5.55V.

d) Peak Through each diode.

$$I_F = \frac{V_{P(sec)} - 0.7}{R_L} = \frac{5.55V}{10K\Omega}$$

$$= 0.555\ mA$$

e) Minimum PIV rating of diodes.

$$PIV = 2V_{P(out)} + 0.7$$
$$= 2(5.55V) + 0.7$$
$$= 11.8V$$

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Question 2:-

Sol.

Turn ratio = 0.1

Peak Primary voltage is = $V_{p(pri)} = 1.414\, V_{rms} = 1.414(120)$
$= 170\,V$

Peak Secondary voltage is = $V_{p(sec)} = n V_{p(pri)} = 0.1\,(170V) = 17V$

Unfiltered peak full wave rectified voltage =

$V_{p(rec)} = V_{P(sec)} - 1.4V = 17V - 1.4V = 15.6$

Frequency of full wave rectifier voltage = 120 Hz.

Peak to Peak ripple voltage at output

$= V_{r(pp)} = \left(\frac{1}{f R_L C}\right) V_{p(rect)}$

$= \left(\frac{1}{(120Hz)(33k\Omega)(10\mu F)}\right) 15.6 = 0.393\,V$

DC value of output voltage =

$V_{DC} = \left(1 - \frac{1}{2fR_LC}\right) V_{P(rect)}$

$= \left(1 - \frac{1}{(240Hz)(33k\Omega)(10\mu F)}\right) 15.6 = 15.4V$

Ripple factor result. $= \gamma = \frac{V_{r(pp)}}{V_{RC}} = \frac{0.393V}{15.4V} = 0.025$

Ripple factor = 2.5 %

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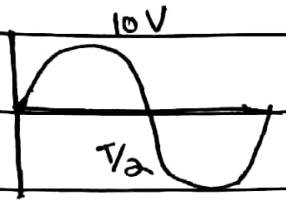
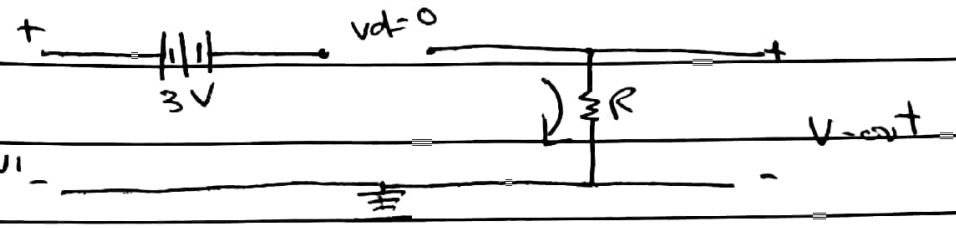
Question 3 :-

Sol :-



$V_i + 3V = 0V$

$V_i = -3V$



$V_o = V_R = I_R(R) = 0(R) = 0$

$V_o = V_i + 3V$

Transition voltage

$V_i + 3V = 10V + 3V = 13V$

$V_o = 0V + 3V = 3V$

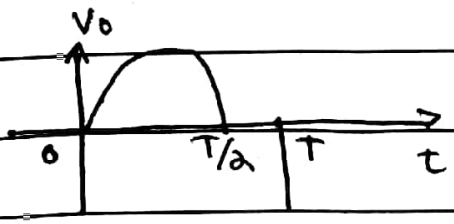
$V_o = -3V + 3V = 0$

output :-

$V_i + 3V = 10 + 3V = 13$

$V_i = 0V + 3V = 3V$

$V_o = -3V + 3V = 0V$



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Question 4:-

Sol:-

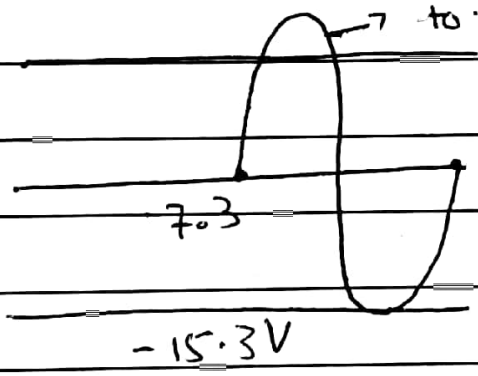
As we know

$\Rightarrow V_{DC} \cong -(V_{p(in)} - 0.7V) = -(8V - 0.7V) = -7.3V$

$\Rightarrow$ The output wave form goes upto +0.7V approximately.

$\Rightarrow$ The output voltage will have an average value of slightly less than calculated.

So the wave form will be



output of voltage waveform.

Question 5 :-

a) Power supply filters (capacitors) are used to smooth the pulsating DC output after rectification so that a nearly constant DC voltage is supplied to the load. It reduces the amount of ripple voltage to a level that is acceptable.

Operation :-

In a filter circuit the capacitor is charged to the peak of the rectified input voltage during the positive portion of the input. When the input goes negative, the capacitor begins to discharge into the load. The rate of discharge is determined by the RC time constant formed by the capacitor and the load's resistance.

The capacitance needed to supply the power supplies output current with specified amount of ripple current (V_{rms}) with full wave rectification is.

$$C = \frac{1}{V_{rms} \times f}$$ Where $V_{rms} = \frac{V_{(p-p)}}{2}$ for $f = 60Hz$

$$C = \frac{2.4\,I}{V_{rms}}$$ I = DC Load current of power supply

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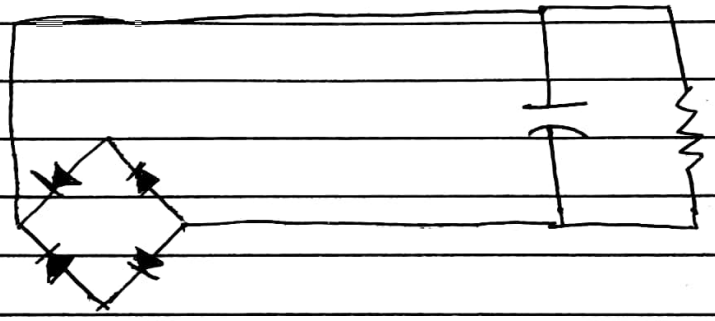
A more general formula is:

$$C \sim \frac{I \times V_{dc}}{V_{rms} V_m 4} \quad \text{where } V_{dc} = \frac{V_m - V_{p-p}}{2}$$

V_m = max. voltage of input waveform
V_{p-p} = peak to peak ripple voltage.



b)

There are two types of semi conductor.

*) Intrinsic
*) Extrinsic.

There are further two types based upon the type of impurity added:

1) N- type
2) P- type.

Formation of N-type semi conductor :-

N-type semi-conductor is doped with the pentavalent impurity like phosphorus antanmy and arsenic. The impurity is added in very minute amount. The pentavalent impurity makes covalent bond with four silicon atoms and electron isn't bonded with any Si atoms. Each penta valent elements impurity donates one e^- to the N-type semi-conductor and it's called donar impurity and in this type electrons are main conductor of current.

Formation of P-type semi conductr :-

The P-type is formed when a tri-valent impurity is added to a pure semi-conductor. In result large no of holes created acts as carriers. These impurities are called acceptor impurities such as galium and indium.

x ——— x ——— x

c) Diode limiters :-

Diode limiter is a circuit in which it takes an input wave form and cuts-off its top-half, bottom half or both together and produces wave forms that resembles flattened version of the input.

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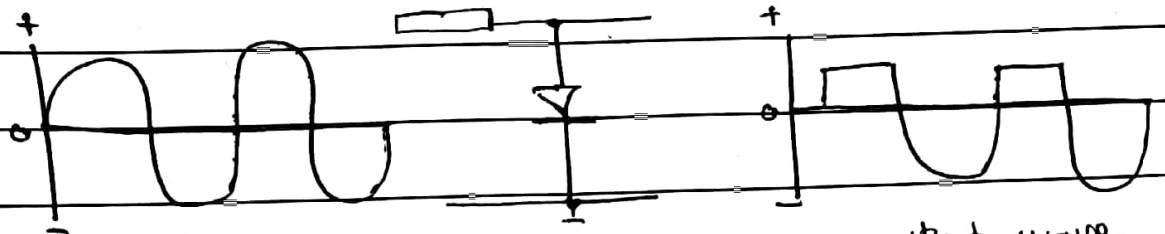
Positive diode limiter :-

In this diode limiting circuit the diode is forward biased. For the diode to become forward biased it must have the input voltage magnitude greater than +0.7 volts. A voltage bias is added in series with the diode.



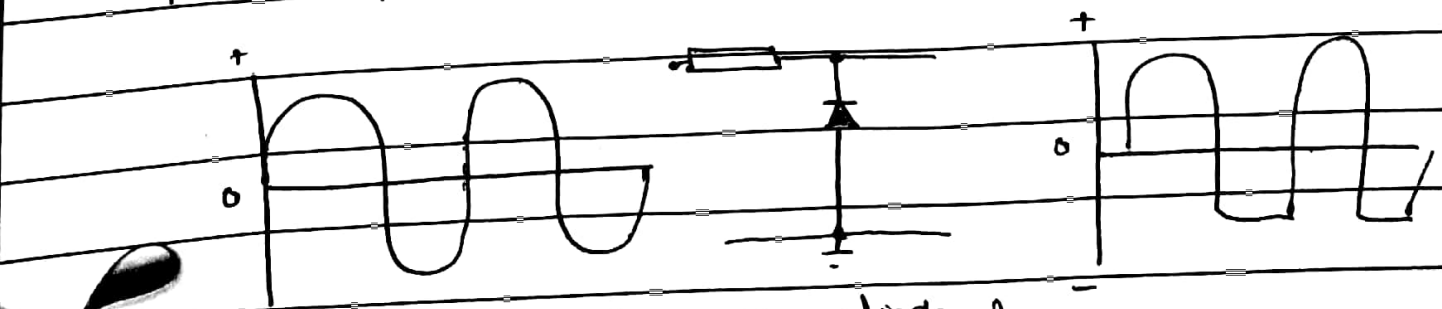
input wave. output wave

positive diode limiter.

Negative diode limiter

When the diode is forward biased during a negative half of the cycle and limits it 0.7V. While allowing the positive half of the cycle is called negative limitors of the circuit.

The output wave form is held to a level -bias-0.7



Negative diode limiter

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d) Capacitor effectively acts as a battery in clamping circuit.

e) The output frequency of half wave rectifier is same to input frequency so if 60 Hz sinosidal voltage is applied then the output will be also 60 Hz.

f) The ripple voltage and load resistance are inversely related to each oth.

↳ Ripple voltage $\propto$ 1/load resistance.

If the load resistance is decreased, the ripple voltage will be incresed

g)

Diode limiter:-

1) It limits the amplitude of output voltage.
2) Output voltage is less than input voltage.
3) Shape of voltage changes.
4) Its DC level remains same.

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Diode clampers.

1) It shifts the DC level of output voltage.
2) Its output voltage is multiple of input voltage
3) Shape remain same.
4) DC level gets shifted.