Name Majid Mahmood

ID 13876

Subject Electronic Device circuit

Exam Summer

* ——————————— *

Question # 1

(Part (a))

Answer: It is a centre-tapped full wave rectifier operation circuit.

Question # 1

(Part b)

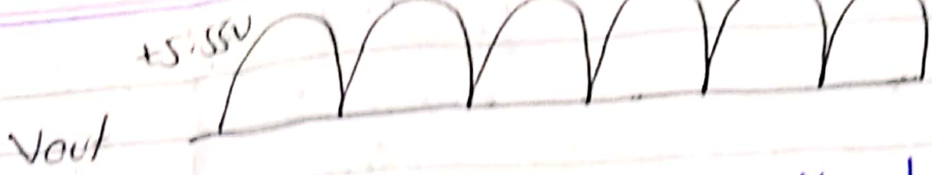
Total peak secondary voltage.

$V_{p(sec)} = n V_{p(pri)} = 0.25(50)$

$= 12.5 \text{ V}$

$$\boxed{V_{p(sec)} = 12.5\text{V}}$$

Question # 1 (c)



There is 6.25V peak to peak voltage the output voltage has a peak value of 6.25-0.7 which is diode drop.

Question # 1

(Part d)

Peak current through each Diode,

$$I_P = \frac{\frac{V_{P(sec)} - 0.7}{2}}{R_L} = \frac{5.55V}{10K\Omega} = 0.000555$$

$$= 0.555\ mA$$

Question # 1

(Part e)

PIV rating must a diode have

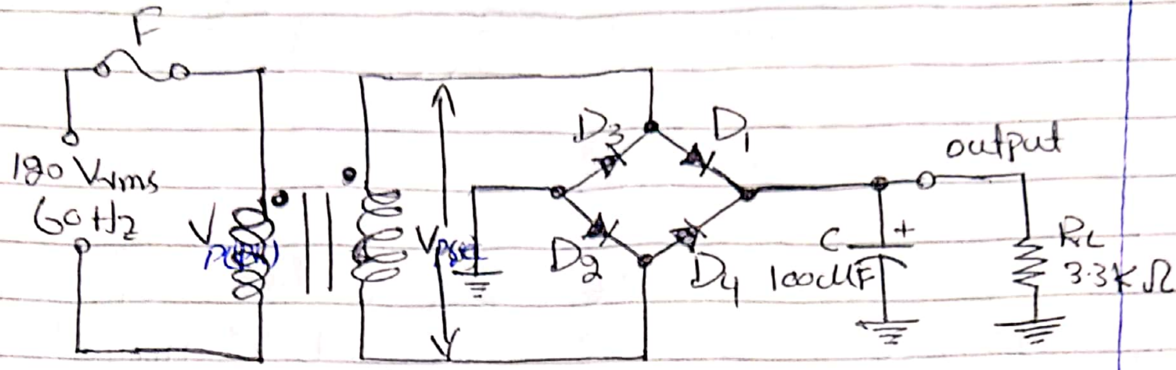
$$PIV = 2V_{P(out)} + 0.7$$

$$= 2(5.55V) + 0.7$$

$$= 11.8V$$

Question # 2

Answer :



Sol: The transformer turns ratio is

$$n = 0.1$$

The peak primary voltage is

$$V_{P(pri)} = 1.414\, V_{rms} = 1.414(120) = 170\ V$$

The peak secondary voltage is =

$$V_{P(sec)} = n V_{P(pri)} = 0.1(170\ V) = 17\ V$$

The unfiltered peak full wave rectified voltage is :

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

$$= 15.6\ V$$

The frequency of full wave rectifier voltage is 120 Hz.

The approximate peak to peak ripple voltage at the output is :

$$V_r(PP) = \left(\frac{1}{f R_{LC}}\right) V_{P(rect)}$$

$$= \left(\frac{1}{(120\,Hz)(3300\,\Omega)(100\,\mu F)}\right) 15.6\,V$$

$$= 0.393\,V$$

The approximate DC value of the output voltage is determined as follows:

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

$$= \left(1 - \frac{1}{(240\,Hz)(3300\,\Omega)(100\,F)}\right) 15.6$$

$$\Rightarrow 15.4\,V$$

The resulting ripple factor is

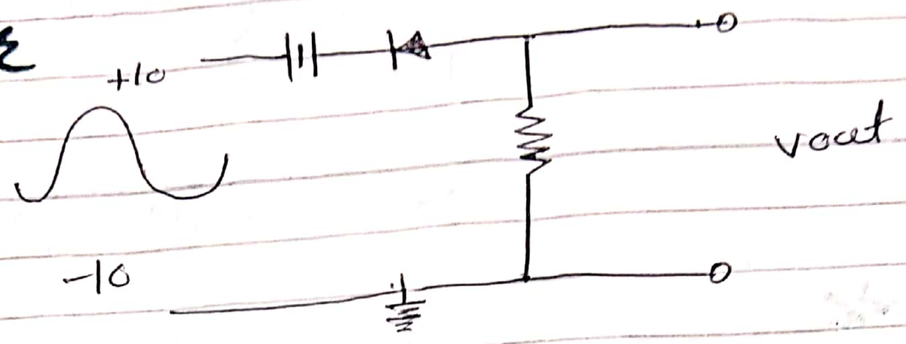
$$r = \frac{V_r(PP)}{V_{RC}} = \frac{0.393\,V}{15.4\,V} \Rightarrow 0.025$$

The present ripple factor is 2.5%

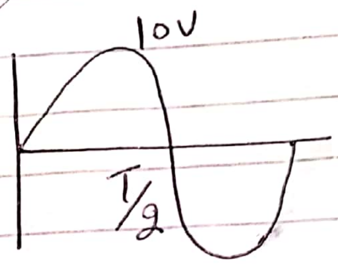
Scanned with CamScanner

Question # 3

Answer

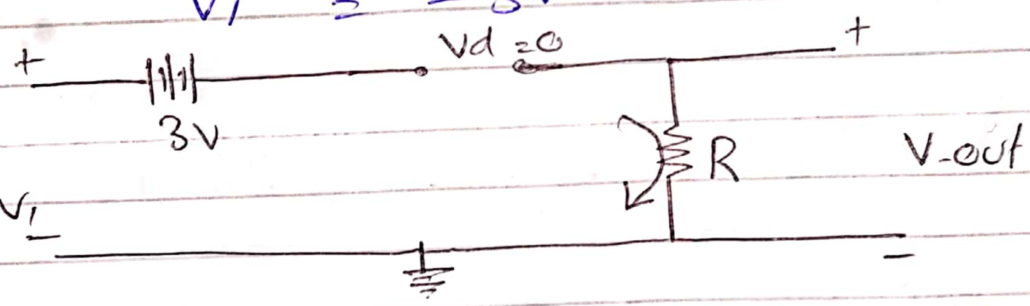


Solution,



$$V_i + 3V = 0V$$

$$V_i = -3V$$



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

$$V_o = V_i + 3V$$

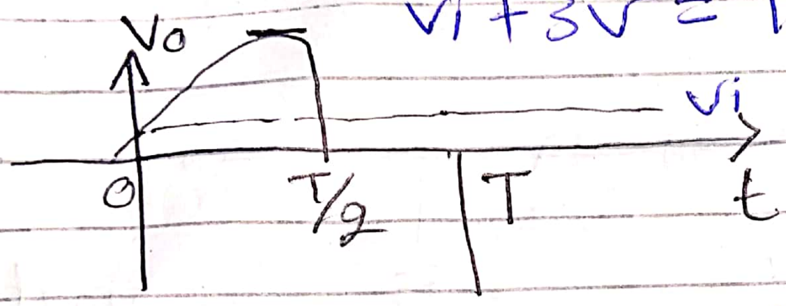
Transition voltage

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

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

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

out put.



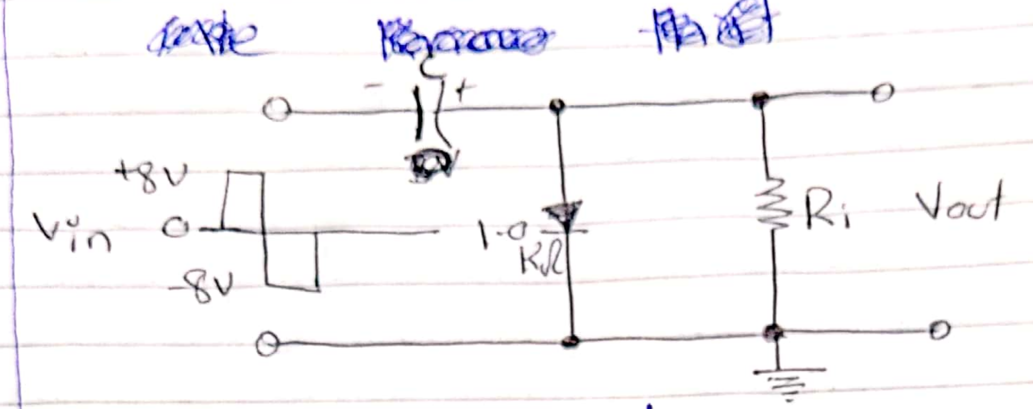
$V_i + 3V = 10 + 3V = 13V$

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

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

Question # 4

Answer:



We know that

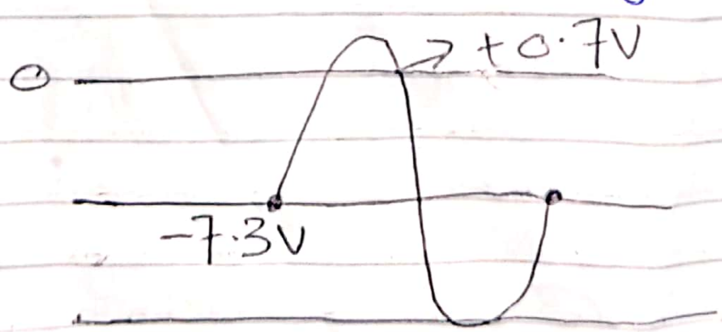
$\Rightarrow V_{DC} \cong -(V_{p(in)} - 0.7V) =.$

$\Rightarrow -(8V - 0.7V) = -7.3V$

⇒ The output wave form goes upto +0.7V approximately

⇒ The output voltage will have an average value of slightly less than calculated.

So the wave form will be



The output voltage wave form.

Question # 5 (a)

Power supply filters:

The ripple components of output voltage is removed by placing a filter circuit. The output voltage of rectifier is pulsating in nature.

It consists of two parts.

1. Desire DC components of voltage
2. unwanted ripple component.

The unwanted comp are removed by power supply filters.

In power supplies capicitors are used to filter the pulsating DC output, so that constant DC voltage is supplied to the load.

Filtor capicetors reduces the ripple voltage to the acceptable level.

In filter circuit capicator is changed to peak of rectified input voltage during positive portion of voltage.

Q#5(a)

When input become negative, the capitators begins to discharge to load. The rate of discharge is determined by RC times constant.

The capicitance value for output current (I) and ripple current (Vrms) is

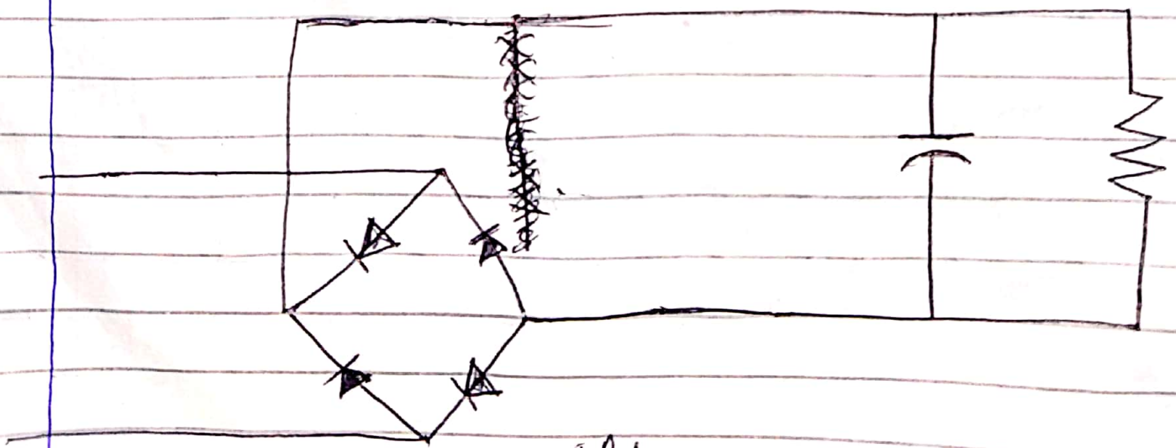
$$C = \frac{1}{V_{rms} \times 4f} \qquad V_{rms} = \frac{V(P-P)}{8} \text{ for } f = 60Hz$$

$$\Rightarrow C = \frac{2.4I}{V_{rms}} \qquad I = \text{DC load current}$$

$$C = \frac{1 \times V_{dc}}{V_{rms} V_{m4}} \quad = V_{dc} = \frac{V_m + V_{P-P}}{2}$$

V_m = maximum voltage

V_{p-p} = peak to peak ripple voltage



Filtering

Question No 5(b)

Ans: Formation of P-type and N-type Semi conductors:

Semi conductors are of two types.
* Intrinsic semi-conductors &
* extrinsic semi-conductors.

The semi-conductors which are doped with impurity atoms are called extrinsic semi-conductor.

=> There are two/2 types based upon the type of impurity added.
① N-type semi-conductor &
② P-typ semi-conductor.

N-type Semi-Conductor: It is a type of extrinsic semi-con-ductor which is doped with a penta-valent impurity element, which has 5/five electrons in its valence shell.

Formation of N-type semi-conductor:

N-type semi-conductor is doped with the pentavalent impurity like phosphorus, antamony and arsenic.

The impurity is added in very minute amount

The penta-valent impurity makes covalent bond with four/4 Sillicon atoms & one electron is not bonded with any Si atoms.
Each pena-valent elements impurity donates one/1 e to the N-type semi-conductor. So it is called Donar impurity.
So in N-type semi-conductor electrons are main conductor of current.

P-type semi-conductors:-

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

For-example:
In tri-valent impurity like galium ~~and~~ is added into germinium crystal in such a way that its three/3 valence e forms a covalent bond with the ~~threes~~ ~~e~~ germinium.
In the four/4 covalent bond only germinium atoms

contributes one valence e', so there is a missing of e' is hole.

Q # 5 (c)

Diode Limitors:

Diode clippers or diode limitors is a wave shaping circuit that takes an input wave form & cuts-off its top-half, bottom half or both halbes togather and produces wave forms that resembles flattened version of the input. There are two/2 types of clippers.

(1) Possitive Diode limitors/clippers:

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.

__Forexample:__

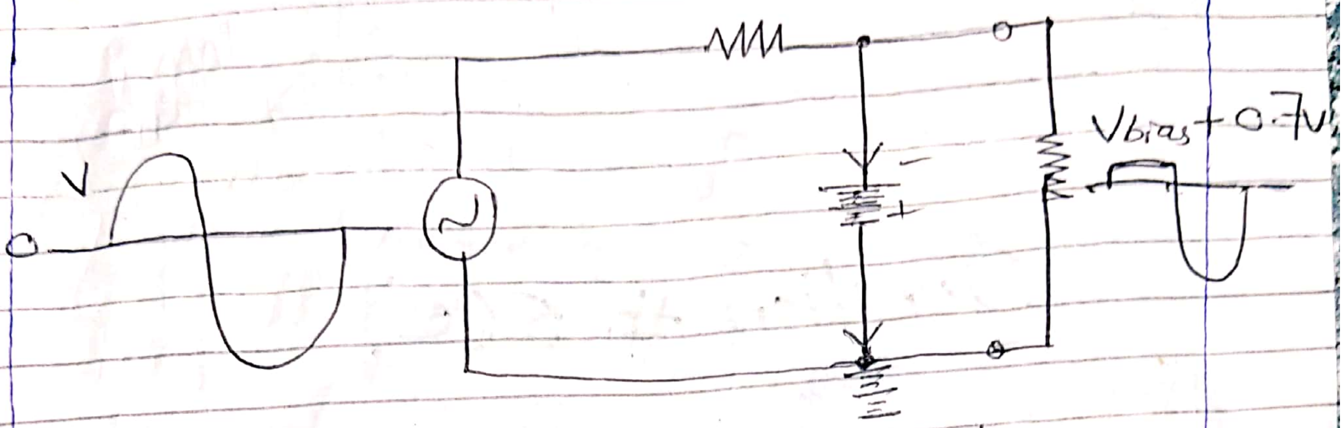
If voltage bias is set 4 volts than the sinosoidal voltage, to the diode annode terminal must be greater than

4 + 0.7 = 4.7 V to become forward bias.

Any voltage level above this

Q #5 (c)

point is cut-off

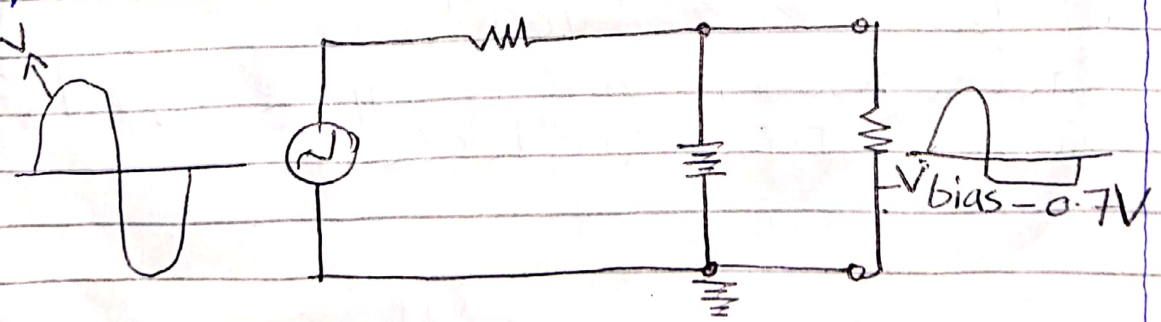


Positive diod limitor.

(2) Negative Diode Limitors:

When the diode is forward biased during a negative half of the cycle and limits it 0.7v, while allowing the possitive half of the cycle is called negative limitors of the circuit.

The output wave form is held to a level - Bias - 0.7V



Negative Diode limitor.

Scanned with CamScanner

Question # 5 (d)

Answer: The capacitor effectively acts as a battery in a climping circuit.

Question # 5(e)

Answer: The output frequency of half wave rectifier is same to input frequency. So if 60 Hz sinusoidal voltage is applied, than the output frequency will also be 60 Hz.

Question 5 (f)

Answer: The ripple voltage and load resistance are inversely related to each other.

Ripple voltag $\propto$ 1/load resistance.

If the load resistance is decreased, the ripple voltage will be increase.

Scanned with CamScanner

Question # 5(g)

Difference between diode limiter and diode climper.

Diode limitor	Diode climper.
① It limits the implitude of output voltage	① It shifts the DC level of output voltage
② out-put voltage less than the input voltage	② Its out-put voltage is multiple of input voltage.
③ The shape of voltage changes	③ shape remain same.
④ Its DC level remain same	④ DC level gets shifted.

Scanned with CamScanner