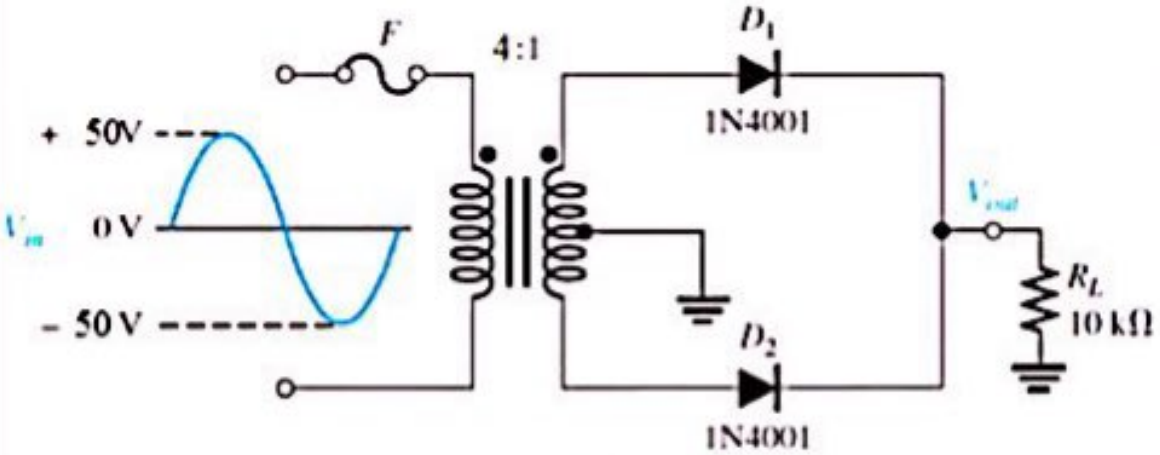
Course Details

Course Title: Electronic Devices and Circuits **Module:** _____
Instructor: _____ **Total Marks:** 30

Student Details

Name: Syed M zahoor **Student ID:** 12595

Student Signature: _____

Q1.		**For the circuit given in figure 1, answer and solve following problems.** a) What type of circuit is this? (1) b) What is the total peak secondary voltage? (1) c) Find the peak voltage across each half of the secondary. (1) d) What is the peak current through each diode? (2) e) What minimum PIV rating must the diodes have? (2)  **Figure 1**	Marks 07 CLO 02
Q2.		Determine the ripple factor for the filtered bridge rectifier with a load as indicated in Figure 2	Marks 05 CLO 02

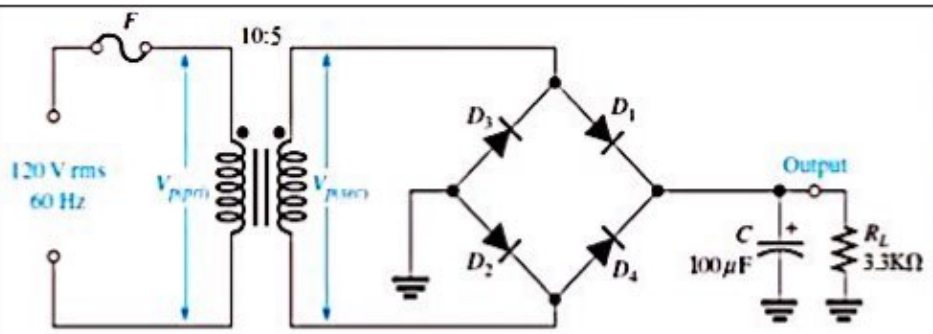


Figure 2

Q3.		Determine the output voltage waveform for the circuit given in Figure 3	Marks 02 CLO 02

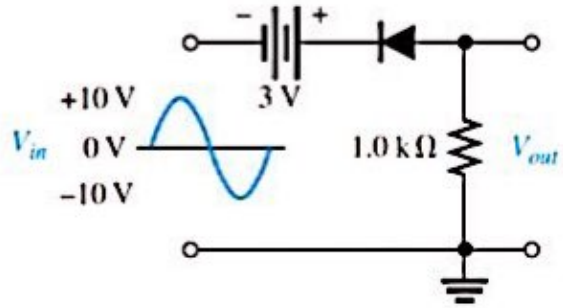


Figure-3

Q4.		Determine the output voltage waveform for the circuit given in Figure 4. Assume the RC time constant is much greater than the period of the input.	Marks 02 CLO 02

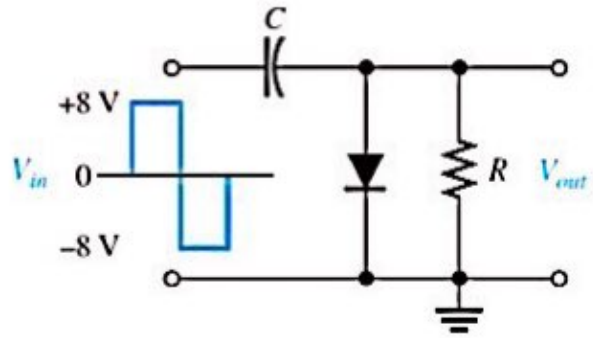


Figure-4

Q5.		**Answer the following questions.** a) What is a Power Supply Filter? Discuss its operation with help of a circuit diagram. (3) b) How are n-type and p-type semiconductors formed? (2) c) What is a diode limiter? What is the difference between a positive limiter and a negative limiter? (3)	Marks 14 CLO 01

		d) What component in a clamping circuit effectively acts as a battery? (1) e) When a 60 Hz sinusoidal voltage is applied to the input of a half-wave rectifier, what is the output frequency? (1) f) If the load resistance connected to a filtered power supply is decreased, what happens to the ripple voltage? (1) g) Discuss how diode limiters and diode clampers differ in terms of their function. (3)	

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(a) What type of Circuit is This?

Ans: It is called Center-tapped full Wave Wave rectifier.

(b) What is total Peak Secondary Voltage?

Ans: $\frac{np}{ns} = \frac{Vp(p)}{Vp(s)}$

$4/1 = \frac{50}{Vp(s)}$

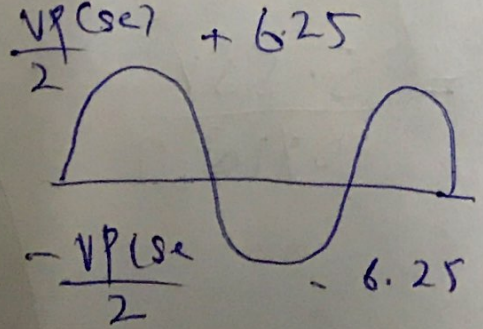
$Vp(s) = \frac{50}{4} = Vp(s) = 12.5$

$Vp(s) = 12.5V$

(c) Find the Peak voltage across each half of the Secondary?

Ans: $Vp(Sec) = 12.5V$

So we can show that the total peack voltage can be given.



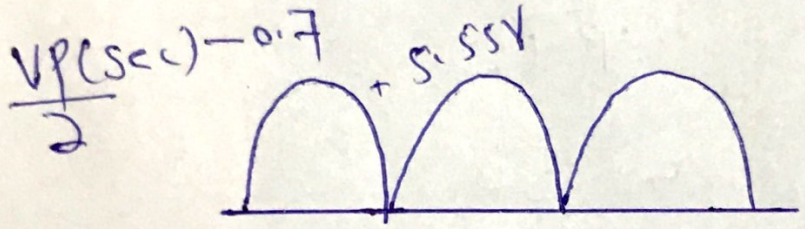
$\frac{Vp(Se)}{2} = \frac{12.5}{2} = 6.25V$

and Voltage across each half after rectification.

$$\Rightarrow \frac{V_p(sec) - 0.7}{2}$$

$$= \frac{12.5 - 0.7}{2}$$

$$= 5.55V.$$



(d) what is the peak current through each diode?

Ans: Let I_{D1} and I_{D2} be the current through diode D1 and D2

Let $I_{D1} = I_{D2} = I_D$

from the figure in the question

$$I_D = \frac{V_D}{R_L} = \frac{\frac{V_p(sec) - 0.7}{2}}{R_L}$$

Putting the values

$$= \left(\frac{\frac{12.5 - 0.7}{2}}{10k\Omega}\right)V = \frac{5.55V}{10 \times 10^3 \Omega}$$

$$= 0.555 \times 10^{-3} A$$

$$I_D = 0.555mA$$

(e) What minimum PIV rating must the diodes have?

Ans Each diode must have a minimum PIV rating of

$$PIV = 2\left(\frac{PV(sec)}{2} - 0.7\right) + 0.7V$$

$$PIV = 2\left(\frac{12.5}{2} - 0.7\right) + 0.7V$$

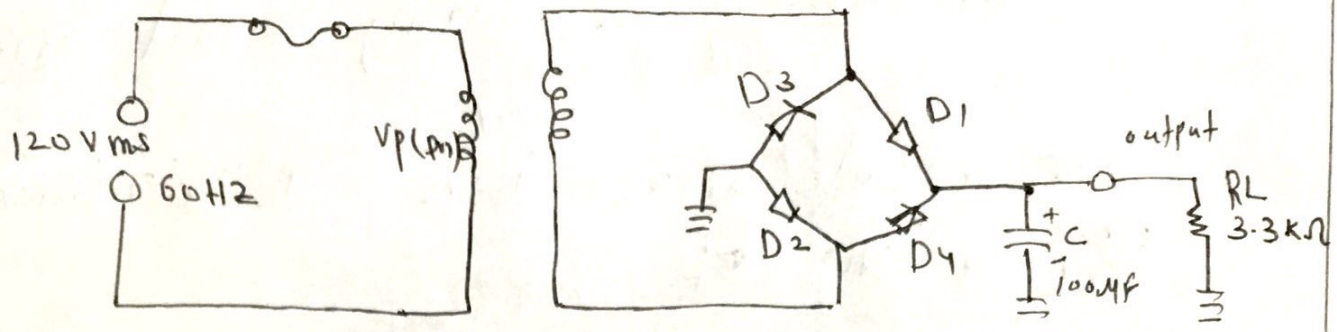
$$PIV = 2(5.55) + 0.7)$$

$$PIV = 11.8V$$

(4)

10:5

(12)



As turn ratio we know

$$n = \frac{N_s}{N_p} = \frac{5}{10} = 0.5$$

We know that

$$V_{p(pri)} = \sqrt{2} \times V_{rms}$$

$$= 1.414213 \times 120$$

$$= 169.705 \approx 170V$$

$$V_{p(pri)} = 170V$$

Also for Peak Secondary Voltage

$$\frac{N_s}{N_p} = \frac{V_{p(sec)}}{V_{p(pri)}}$$

$$\Rightarrow V_{p(sec} = \frac{N_s}{N_p} (V_{p(pri)})$$

$$= \frac{5}{10} (170) = 0.5 \times 170$$

$$V_{p(sec)} = 85V$$

The rectified voltage before filter will be:

$$V_{p(rect)} = V_{p(sec)} - 1.4V$$
$$= 85V - 1.4 = 83.6V$$

The output frequency of a full wave rectifier is twice as the input i.e $60 \times 2 = 120Hz$

So the approximate output peak to peak ripple voltage will:

$$V_{r(pp)} \cong \left(\frac{1}{fRLC}\right) V_{p(rect)}$$

$$\left(\frac{1}{(120Hz)(3.3k\Omega)(100\mu F)}\right) 83.6V$$

$$V_{r(pp)} = (0.025252525)\, 83.6V$$

$$= 2.11111V$$

The approximate dc output voltage

$$V_{CD} = \left(1 - \frac{1}{2fRLC}\right) V_{p(rect)}$$

$$V_{CD} = \left(1 - \frac{1}{2(120Hz)(3.3k\Omega)(100\mu F)}\right) 83.6V$$

$$V_{DC} = (1 - 0.12626)(83.6V$$

$$V_{DC} = (0.987373)\, 83.6V$$

$V_{DC} = 82.5444V$

Now atlast we can calculate ripple factor.

$$\gamma = \frac{V_{r(pp)}}{V_{DC}}$$

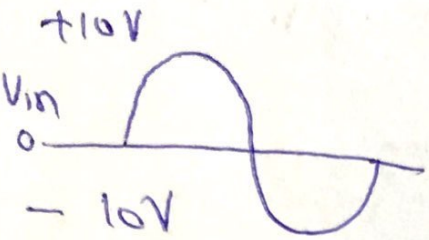
Putting values

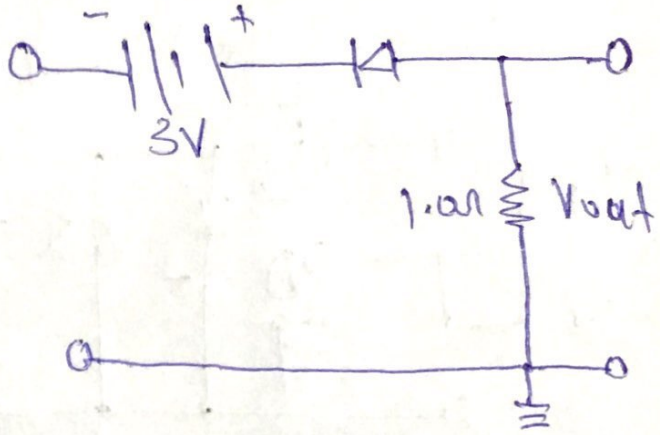
$$\gamma = \frac{2.1111V}{82.5444V}$$

$$\gamma = 0.02557544$$

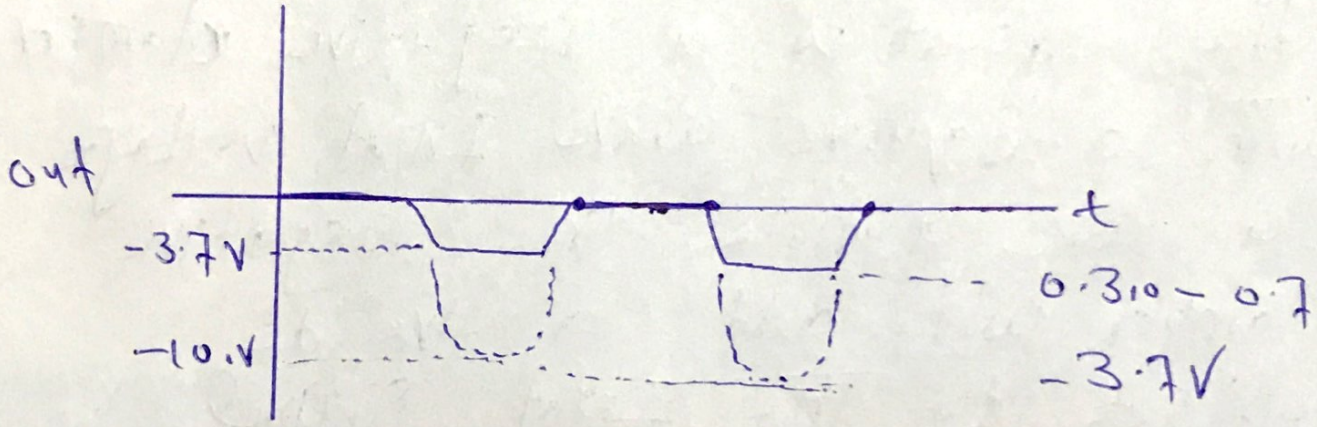
The percent ripple will be 2.557 %.

(Q3) Determine The output voltage waveform for The circuit given in fig (3)



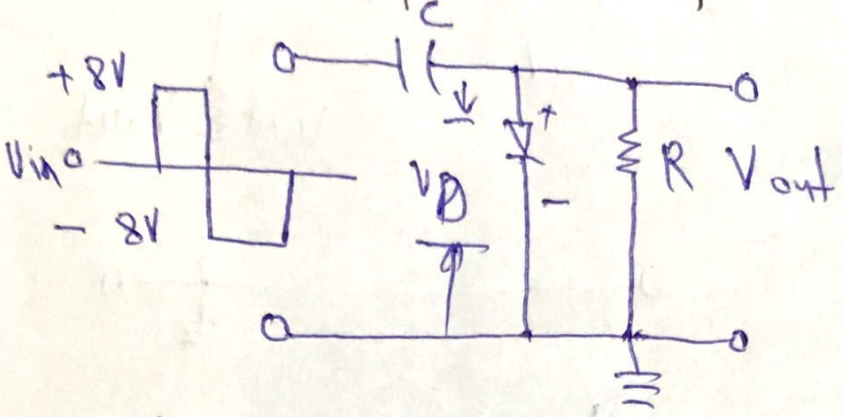


Solution



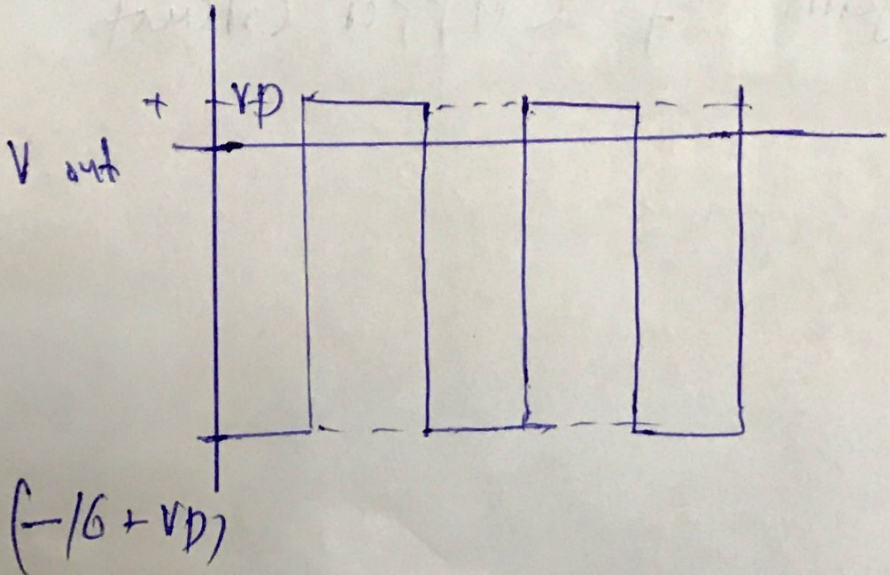
out waveform of clipper circuit

(Q4) Determine the output voltage waveform for the circuit given in figure 4. Assume the RC time constant is much greater than the period of the input.



Solution:

The circuit is a negative clamper with a square wave Input voltage so as a whole the negative clamper will add a -ive dc offset to the Input signal



(Q5A) Answer The following questions.

(a) what is a power Supply filter? Discuss its operation with help of a circuit diagram.

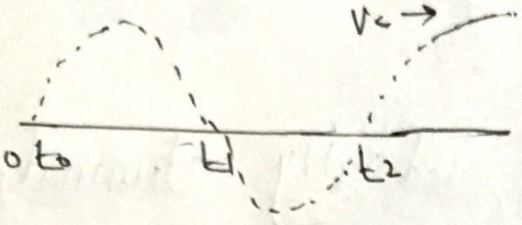
Ans: * A power Supply filter ideally eliminates the fluctuations in the output voltage of a halfwave or full wave rectifier and produces a constant level dc-voltage.

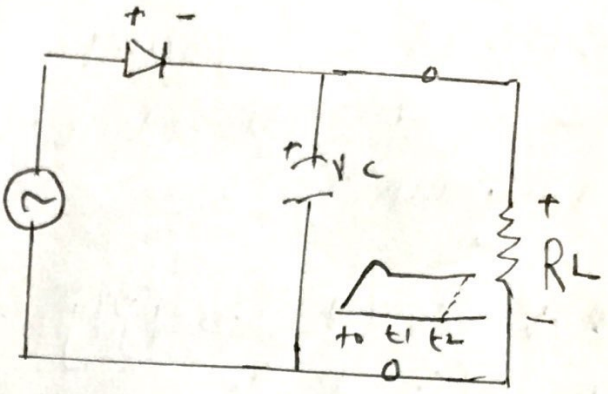
* The filter is simply a capacitor connected from the rectifier output to ground.

* The output of a filter is nearly smooth dc output voltage.

* The small amount of fluctuation in the filter output voltage is called ripple.

Operation of Power Supply filter:





(a) Initial charging of the Capacitor (diode is forward-biased) happens only once when power is turn on.

(b) The capacitor discharges Through RL after peak of Positive alternation when diode is reverse Biased. The discharging occurs during the Portion of the Input voltage Indicated by the Solid dark blue curve.

(c) The Capacitor charges back to peak of Input when the diode becomes forward biased This charging occurs during the Portion of the Input voltage Indicated by Solid dark blue curve

Q(5)(B) How are n-type and P-type Semiconductor formed?

Ans: N-type and P-type Semiconductors are formed through a process called droping which resist in extrinsic (impure) Semi conductor materials.

Doping is a process of controlled addition of Impurities to Intrinsic (pure) Semiconductor material so Their Conductivity Can drastically Increased

* N-type Semiconductor are formed by adding a Pentavalent Impurity atom in a Silican crystal Structure for example antimony (Sb) is added & its extra electron becomes a free electron.

* P-type Semiconductor are formed by adding a trivalent Impurity to increase the no of holes. for Silicon (Si), Boron (B), trivalent Impurity is added.

Q5 (c)

Ans: Diode Circuit called limiters or clippers are Some times used to clip off portions certain levels.

There are two types of basic diode limiter / clippers positive limiter or negative climiter.

Diode positive limiter limits or clips off the positive part of the Input voltage where diode negative limiter limits or clips of a certain negative part of there Input voltage Just by turning around by diode of Circuit.

Q5 (d)

Ans: Capacitor is the Component in a clamping Circuit That effectively out as a battery.

Q(5)(e)

Ans:- When a 60Hz Sinusoidal voltage is applied to the Input of a halfwave rectifier the output frequency remain Same That is 60Hz.

Q(5)(f)

Ans: If the load resistance connected for a filtered Power Supply is decreare then the ripple voltage is increased

Q(5)(g)

Ans:- Diode limiters are used to clip off portions of Signal voltages above or below certain levels whereas clampers are circuits used to add a Dc offset or a Dc level to an Ac voltage

* Limiters are also called as clippers and clampers are also called as Dc restorers.

→ Diode limiters are of two types positive clippers ~~and~~ or Negative clippers and Clampers are of two types. Positive clamper or negative Clampers.