**Department of Electrical Engineering**
**Midterm Exam**
**Date: 25/04/2020**

## Course Details

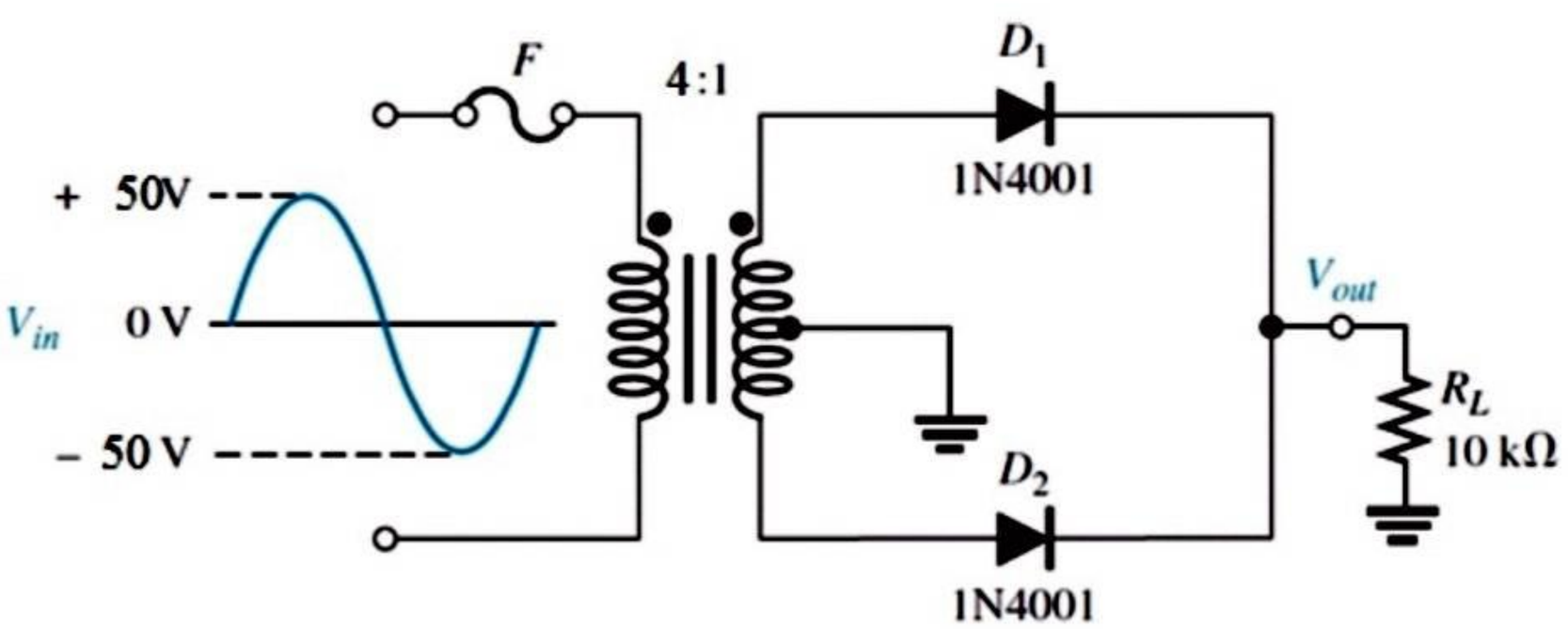
**Course Title:** Electronic Devices and Circuits **Module:** _____
**Instructor:** _____ **Total Marks:** 30

shehriyar khan

## Student Details

**Name:** 13738 **Student ID:** _____

**Student Signature:** _____

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

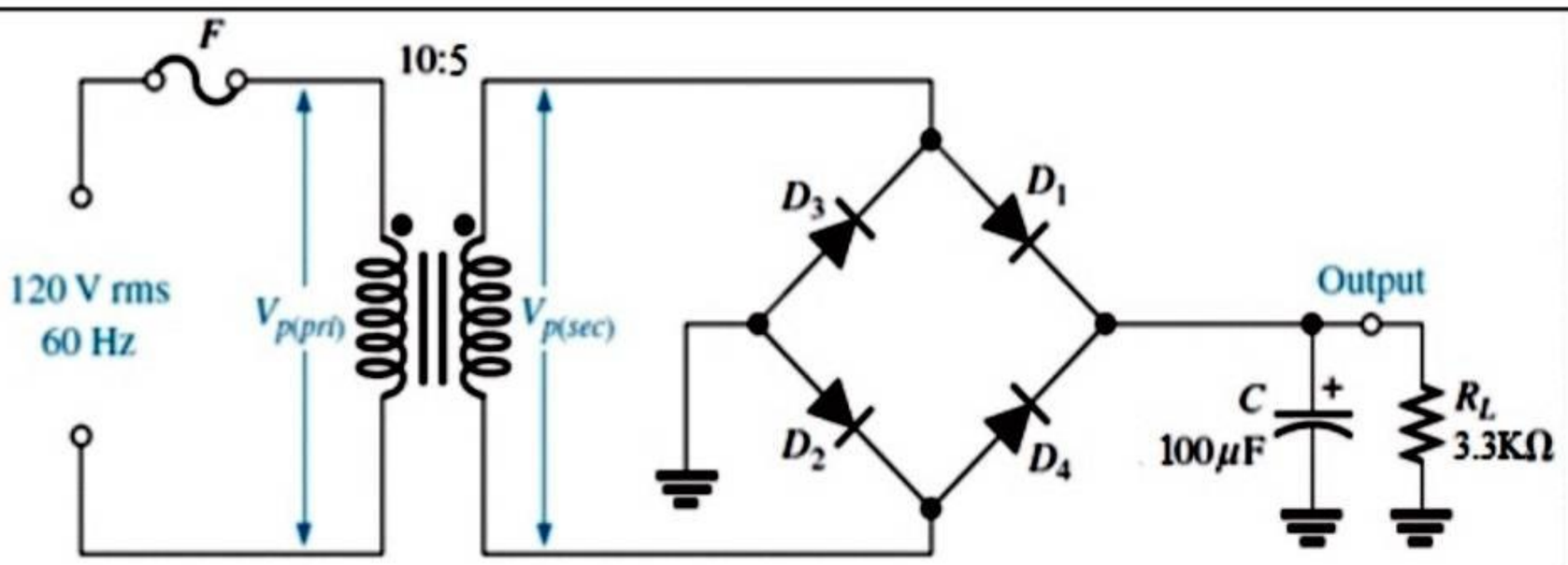



**Figure 2**

| | | | |
|---|---|---|---|
| Q3. | | Determine the output voltage waveform for the circuit given in Figure 3 | Marks 02<br>CLO 02 |

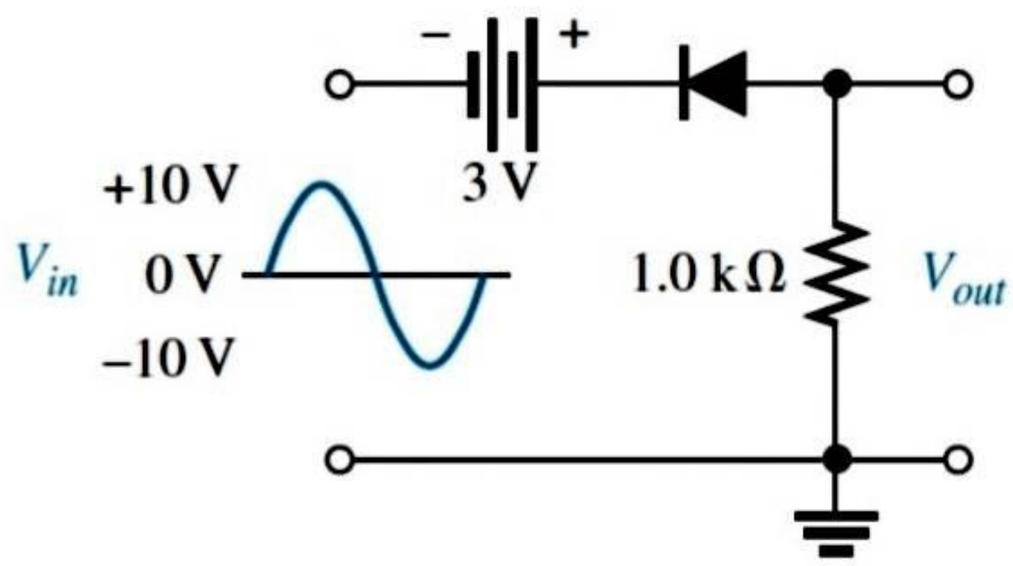



**Figure-3**

| | | | |
|---|---|---|---|
| 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<br>CLO 02 |

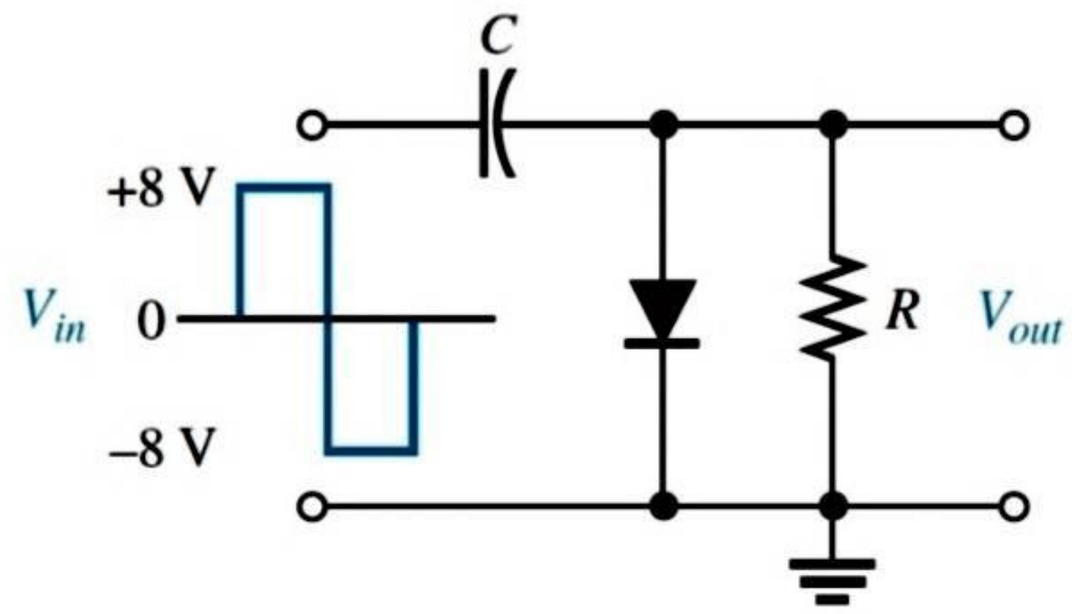



**Figure-4**

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

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

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BE(Electrical)

(Q NO 1)

(a) It is a center type full wave rectifier

(b) The transformer turns ration $n = 0.25$
The total peak secondry voltage is
$V_p(sec) = n V_p(pri) = 0.25 (50V) = 12.5V$

(c) There is a 6.25 peak across half of the secondry with respect to ground. The output load voltage has a peak value of 6.25V, less then 0.7v drop across the diode.

(D) $I_F = \frac{\frac{V_p(sec)}{2} - 0.7V}{RL} = \frac{\frac{12.25}{2} - 0.7}{10\,K\Omega}$

$I_F = \frac{6.25 - 0.7}{10K\Omega} = 0.55\,mA$

(e) $Piv = 2vp(out) + 0.7v = 2(6.25) + 0.7V$

$Piv = 13.2\ V$

Q NO2:

The transfermer turn ratio is $n = 0.5^-$

The primary voltage is

$Vp(Pri) = 1.414\ Vrms = 1.414\ (120) =$ 170 V.

The peak Secondry voltage is

$Vp(Sec) = n\ Vp(Pri) = 0.5^-(170) = 85V$

The unfiltered peak full Wave rectifier voltage is

$vp(rec) = Vp(Sec) - 1.4V = 85^- - 1.4 = 83.6V$

The frequancy of a full Wave rectifier voltage is 120 HZ. The approximate peak to peak ripple voltage at output is

$$V_{r(pp)} \cong \left(\frac{1}{fR_LC}\right) V_{p(rect)} = \frac{1}{120(H2)(3.3K\Omega)(100\mu F)} 83.6$$

$$V_{r(pp)} = 2.11V.$$

The approximate dc value of the output voltage determine as follows.

$$V_{DC} = \left(1 - \frac{1}{2fR_LC}\right) V_{p(rect)} = \left(1 - \frac{1}{(240HZ)(3.3K\Omega)(100\mu F)}\right) 83.6$$

$$= \left(1 - \frac{1}{39.6}\right) 83.6$$

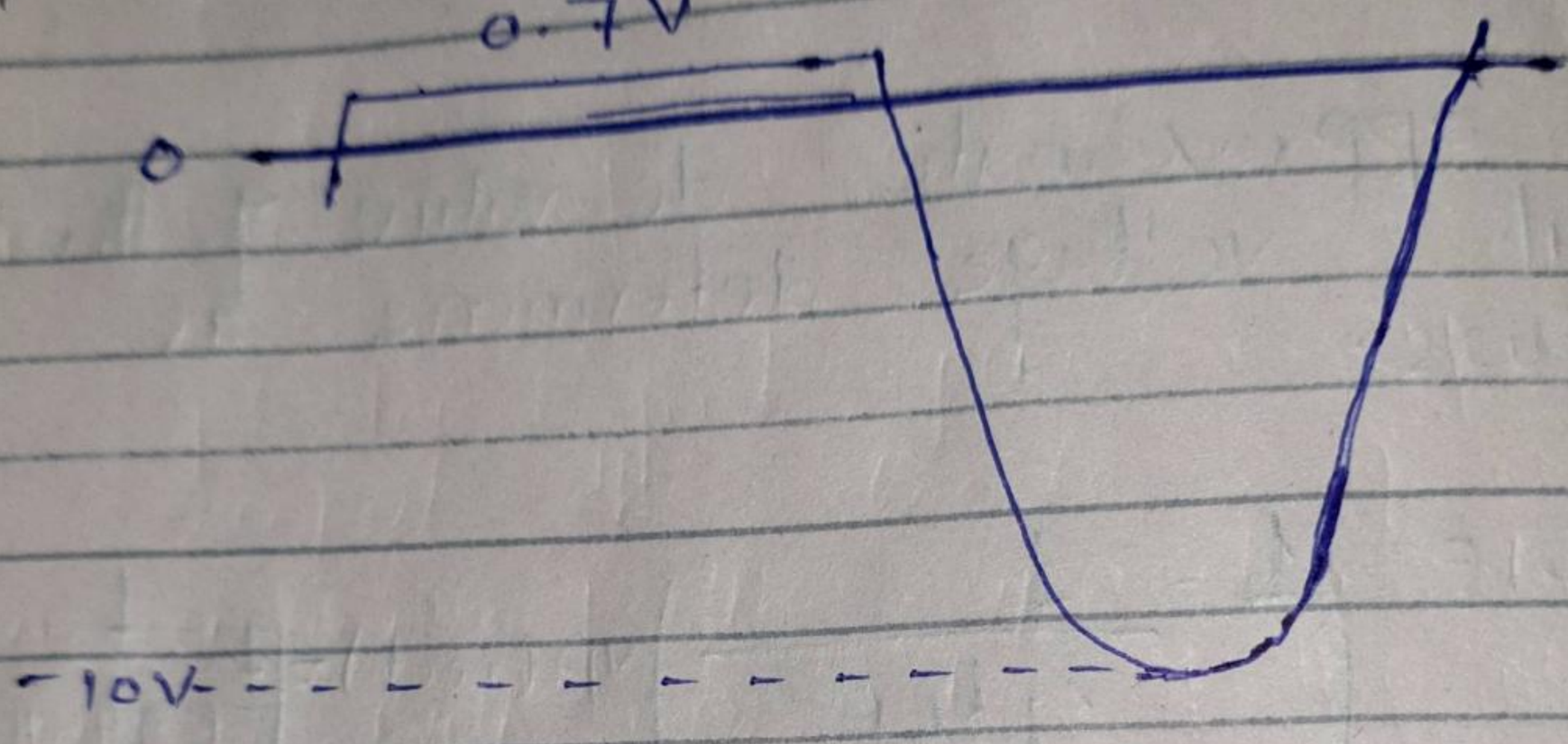
$$V_{DC} = 81.48\ V$$

The resulting ripple factor is

$$r = \frac{V_{r(PP)}}{V_{DC}} = \frac{2.11}{81.48} = 0.026$$

The percentage ripple is = 2.62%.

Q No 3:




Q NO 4:

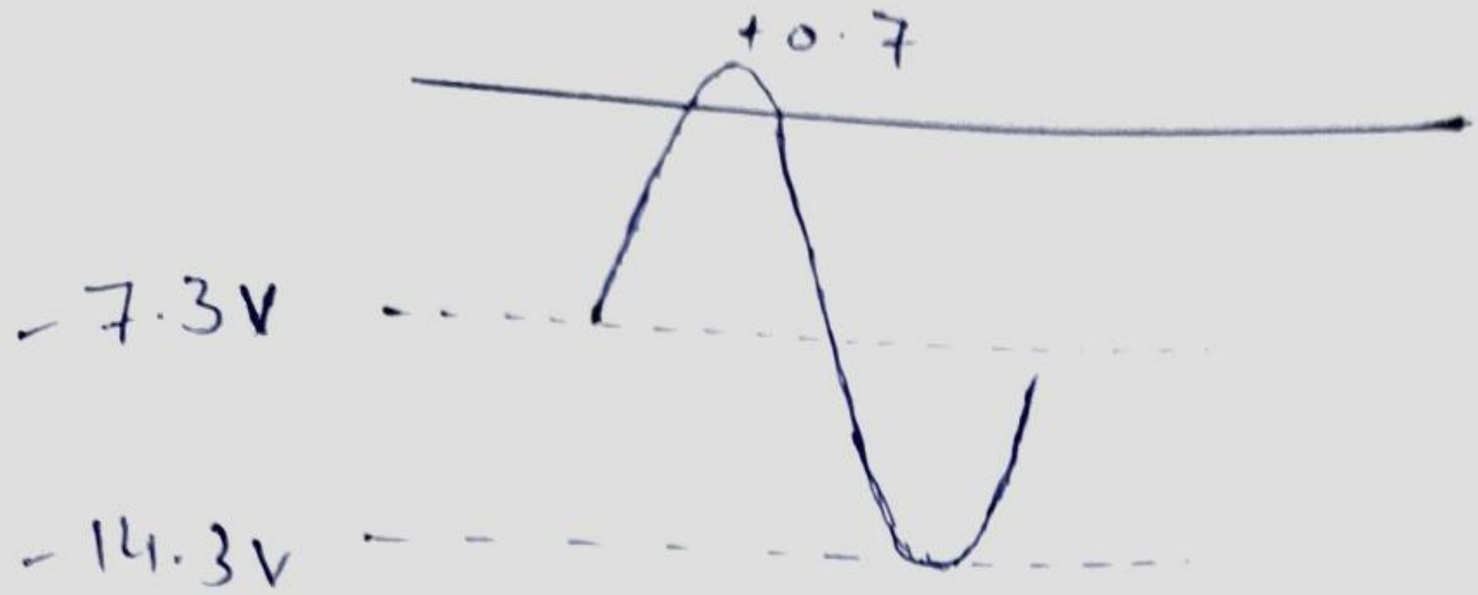
Ideally, a negative dc value equal to input peak less the diode drop inserted by the clamping circuit.

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

$$= -(8V - 0.7V)$$

$$= -7.3V$$

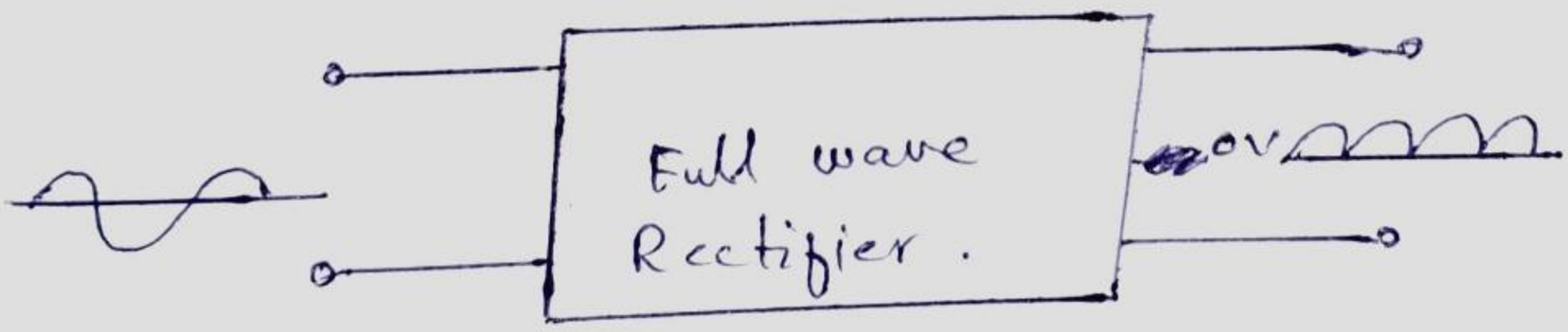
Wave form :-



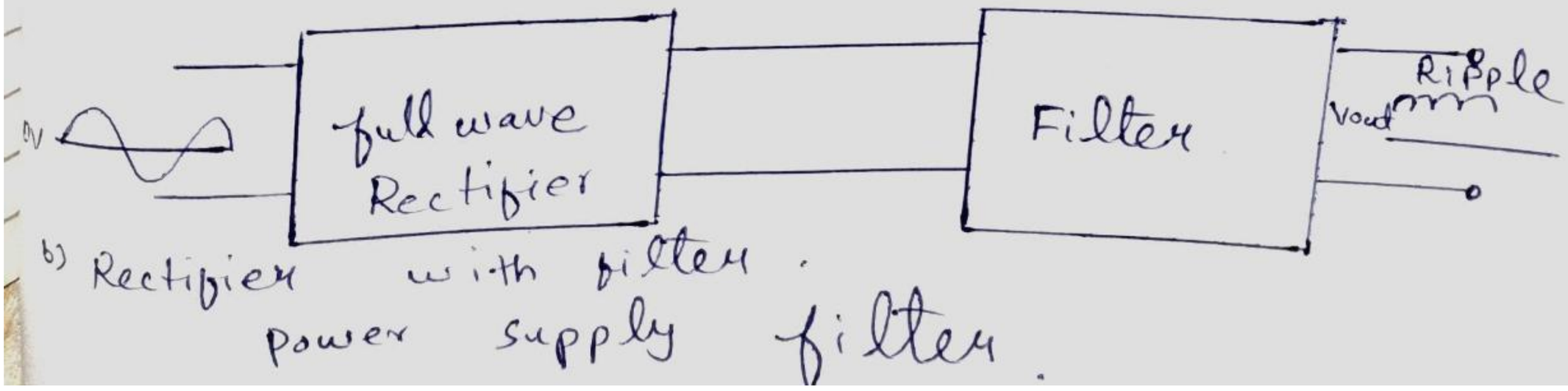

QNO5 :

Answer : power supply filter :

→ A power supply filter ideally eliminates the fluctuations in the output voltage of a half wave or full wave rectifier and produces a constant-level dc voltage.




a) A Rectifier with out filter.




b) Rectifier with filter.

power supply filter.

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

(2) RL represents the equivalent resistance of a load.

(3) The positive first quarter-cycle of the input, the diode is forward bias, allawing the capacitor to charge with in 0.7v of the ~~out~~ input peak

(3) When the input begins to decrease below its peak. the capacitor retains its charge and the diode become reverse biased. because the cathod is more positive than anode

(4) During the remaining part of the cycle, the capacitor can dis-charge only through the load resistance.

Q NO 5 (b):

## N-type Semiconductor:

An N-type Semiconductor are formed When a small amount of pentavalent impurity is added to a pure Germinium or Silicon crystal. The addition of pentavalent impurity produce a large no of free electrons in the host crystal.
Thus the majority carrier in N-type Semiconductor are free electrons.

## p-type Semiconductor:

The p-type Semiconductor is formed When a trivalent impurity is added to a pure Semiconductor in a small amount and

as a result large no of holes are provided in the semiconductor material by the addition of trivalent impurities like, Gallium and indium. Such type of impurities which produces p-type semiconductors are know as an acepter impurities because each atoms of them create one hole which can accept one electron.

(Q No 5)(C):

Ans: Diode circut is called Diode limiter or clippers, are some time used to clip off portion of signal voltages above or below.
Differance b/w Diode positive & Diode Negative.

- Diode positive limiter that limits or clips the positive part of the input voltage.

. As the input voltage goes positive the doide becomes forword bias and conduct current.

. The Diode negative limiter that limits or clip the negative part.

. When the input voltage goes back below 0.7v, the diode is reverse biased and appears as an open blocking current flow through itself and as a result has no effect on the negative half on the sinosioded voltage which passes to the load unattered.

QNO 5 (d):

The capacitor retain a charge in a clamping circuit and effectively act as a battery

QNO 5 (e):

A SinoSidal voltage is twice that of the half wave

So output frequency = 120 Hz.

Q NO 5 (f)

Ripple voltage in the presence of filter capacitor, is inversly proportional to load resistance. If load were zero. Then there would be no ripple voltage. As the load increases the ripple voltage increases.

Q NO 5 (g):

Diode limiter:

- Diode circuits called diode limiter. or clippers, are sometimes used to clip off portions of signal voltage above or below certain levels

Diode positive limiter that limits or clips the positive part of the input voltage.

. As the input voltage goses positive, the diode becomes forward baised and conducts current.

Diode Clampers:

. A ~~tha~~ clampers adds a dc level to an ac voltage & are also known as DC restores.

. A clampers circuit includes diodes. resistors and capacitors

. Diode is connected in parellel with load and polarity of diode determine the direction of dc offset to be added to the signal.

. This allows the capacitor to charge to its peak value in a very short span of time.