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

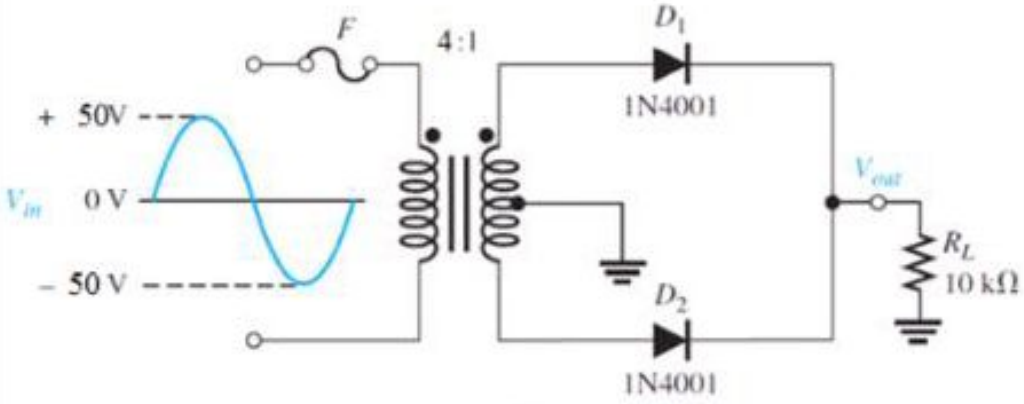
Course Details

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

Student Details

Name: _____ **Student ID:** _____

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

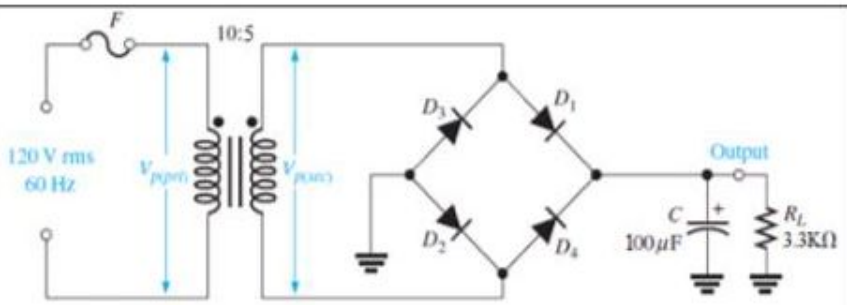


Figure 2

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

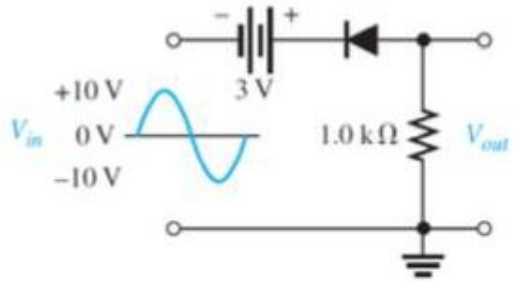


Figure-3

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

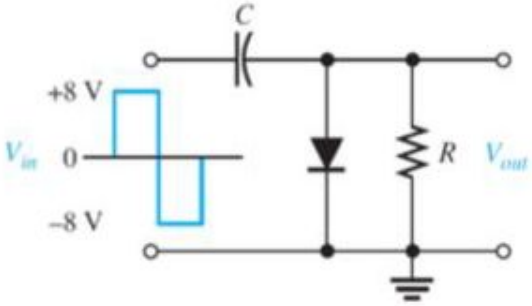


Figure-4

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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Instructor: Dr Shaheryar sir. Date: 25/08/2020

Department: Electrical Engineering

Course Title: Electronic devies & circuits.

Q No 1:-

a):-

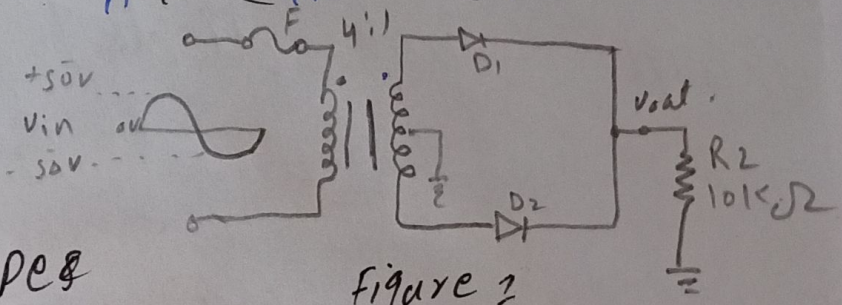


figure 1

what types of circuit is this?

Ans:- The given figure circuit is center tapped Full-wave rectifier transformer circuit.

b):- what is the total Peak Secondary voltage?

Sol:- The transformer turns ratio, $n = 0.25$

The totale Peak secondary voltage is.

$V_{p(sec)} = nV_{p(pri)} = 0.25(50\,V) = \underline{12.5\,V}$

c):- Find the peak voltage across each half of the secondary?

Ans:- There is 6.25 V peak across each half of the secondary with respect to ground.

d):- What is the peak current through each diode?

Ans:- The peak current through each diode is

$I_{peak} = \frac{6.25\,V}{10k\Omega} = 0.625\,mA \cdot \frac{5.55}{10k\Omega} = 0.000555\,A$

$= \underline{0.555\,mA}$

e):- What minimum PIV rating must the diode have?

Ans:- Each diode must have a minimum PIV rating of

$PIV = 2V_{p(out)} + 0.7 = 2(5.55\,V) + 0.7$

$= \underline{11.8\,V}$

Q No 2 :-

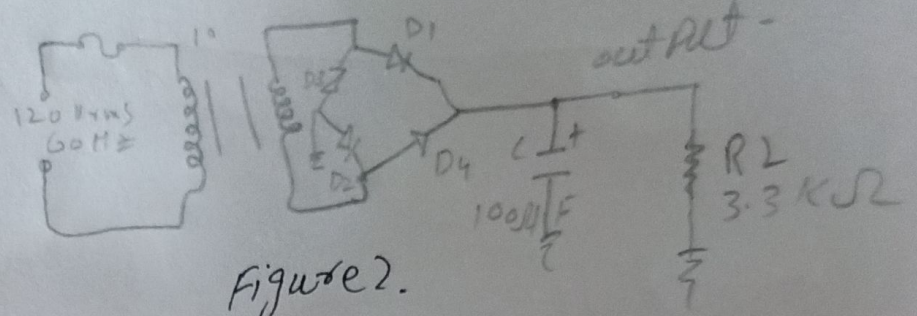


Figure 2.

Sol:- The transformer turns ratio $n = 0.5$

The peak pri voltage is

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

The peak secondary voltage is

$$V_{p(se)} = n V_{p(pri)} = 0.5(170V) = 85.0V$$

The unfiltered peak Full-wave rectified voltage is

$$V_{p(rect)} = V_{p(sec)} - 1.4V = 85.0V - 1.4V \cong 83.6V$$

The frequency of a Full-wave rectified voltage 120Hz the approximate peak to peak ripple voltage at the output is

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

$$= \left(\frac{1}{(120\,Hz)(3300\Omega)(0.0001F)}\right)83.6V$$

$$= 2.11\,V$$

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

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

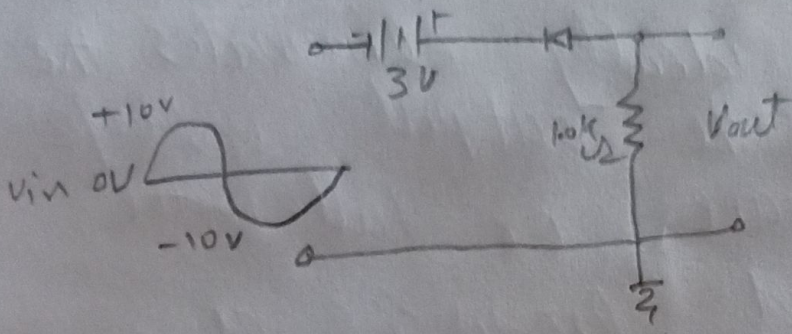
$$= \left(1 - \frac{1}{(240\,Hz)(3300\Omega)(0.0001F)}\right)83.6$$

$$= 83.48V$$

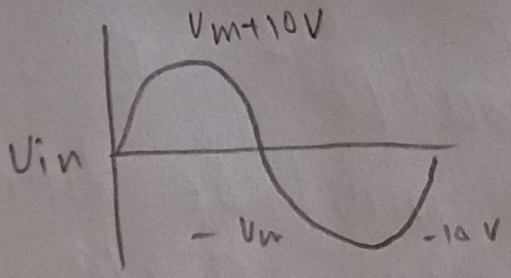
the resulting ripple factor is

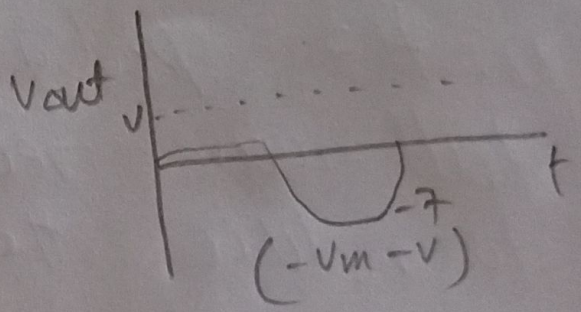
$$\gamma = \frac{V_{r(PP)}}{V_{DC}} = \frac{2.11\,V}{83.48V} = 0.025$$

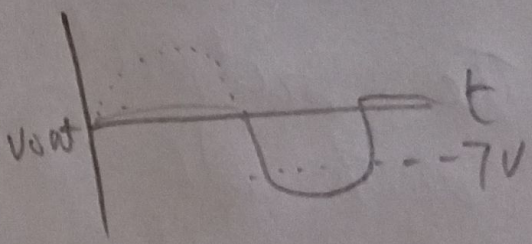
QNo3:- determine the output voltage waveform for the circuit given in Figure 3.



Ans:- The output voltage waveform of clipper circuit is







QNo5:-

a):- what is power supply Filter? Discus its operation with help of a circuit diagram.

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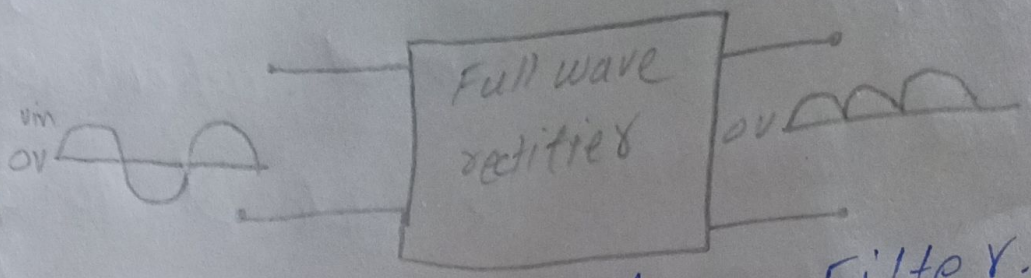
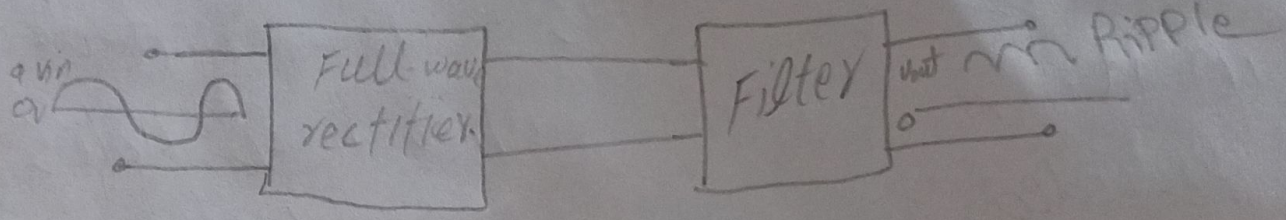
Ans:- Power Supply Filters:- A power supply filter ideally eliminates the fluctuations in the output voltage of a halfwave or full-wave rectifier and produces a constant-level dc voltage. The 60 Hz pulsating dc output of a half-wave rectifier or the 120 Hz pulsating output of a full-wave rectifier must be filtered to reduce the large voltage variations.

The output of a filter is nearly smooth dc output voltage. The small amount of fluctuation in the filter output voltage is called ripple.

Diagram :-



Rectifier without a Filter.



Rectifier with a Filter.

b) :- How are n-type & P-type semiconductors formed?

Ans :- N-type semiconductor :-

To mak n-type semiconductor, pentavalent impurities like phosphorus or arsenic are added. Four the impurities electrons form bonds with the surrounding silicon atoms, Since electrons are negative charge carriers, the resultant materiel is called an n-type semiconductor.

P-type semiconductor:- The extrinsic P-type semiconductor is formed when a trivalent impurity is added to a pure semiconductor in a small amount and as a result, a large numbers of holes are created in it. A large number of holes provided in the semiconductor by the addition of trivalent impurities like Gallium and indium.

c) what is diode limiter? what is the different b/w positive limiter & negative limiter.

Ans:- Diode Limiter:- The Diode clipper, also known as a diode limiter, is a wave shaping circuit that takes an input waveform and clips or cutoff its top half, , bottom half or both halves togthers.

Different b/w Positive & Negative limiter:

The series negative limiter limits the negative portion of the out put pluse. The difference b/w a seriese negative limiter and a seriese positive limiter is that the diode is reversed in the negative limiter and in the parallel positive limiter the positive portion of the input signal is limited when the diode conducts.

d):- What component ina clamping circuit effectively act as a batter?

Ans:- AS Vin becomes negative, the capacitor act as a battery of the same voltage of Vin. The voltage source and the capacitor counteract each other, resulting in a net voltage of zero as seen by the load.

e):- when a 60 Hz sinusoidal voltage is applied to the input of a half-wave rectifier what is the output frequency?

Ans:- The output frequency of half-wave rectifier is equal as input this means as input complete one cycle at output also complete one cycle.

f):- if the load resistance connected to a filtered power supply is decreased what happens to the ripple voltage?

Ans:- when the load resistance connected to a filtered power supply the ripple voltage remain same.

9) Discuss how diode limiter and diode clampers differ in terms of their function.

Ans:- The major difference between clipper and clamper is that the clipper is a limiting circuit which limits the output voltage while clamper is a circuit which shifts the DC level of output voltage. the clipper and clamper circuit are exactly opposite to each other regarding the work principle.

Q No 4:-

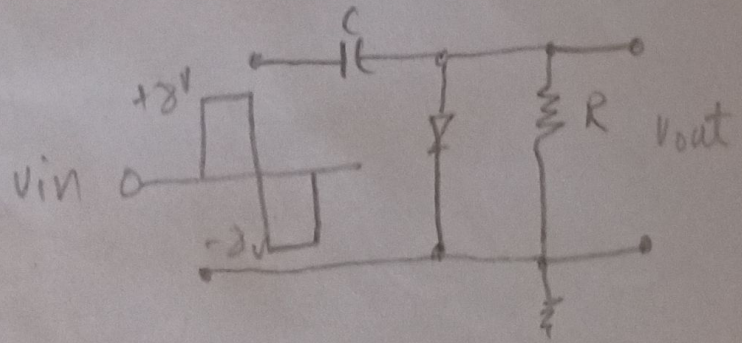


Figure 4.

Ans:- Assume the RC time constant is much greater than Period of input

So if we take ($5\tau_{discharge} \geq$ so $T/2$) thus we obtain condition for the clamping operation.

$$T_{discharge} \geq 5T$$

So $V_o = v_i - V + V_{D(on)}$ ∵ T is the Perm of input signal V_D