**Midterm Exam - CSE210 (Electronics I)**

**Department of CSE, Independent University, Bangladesh (IUB)**

**Autumn Term 2023, Date: 04-09-2023**

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| **Name** |  |
| **Student ID** |  |
| **Section** |  |

* This paper contains 6 problems.
* Duration of the exam: 75 minutes.
* Total marks: 50
* This is a closed-book exam, and calculators are allowed.
* Student/s caught guilty of adopting any unfair means shall be expelled from the examination hall immediately and examination of such student/s including the outcome shall be terminated/cancelled right away

**Problem 1**

1. For Fig. 1 Determine I, V1, V2, and Vo .
2. Considering R1 = 0 Ω and DC source E1 is replaced by an AC source vi a sinusoide with peak value vm = 10 V, determine and sketch the output Vo .

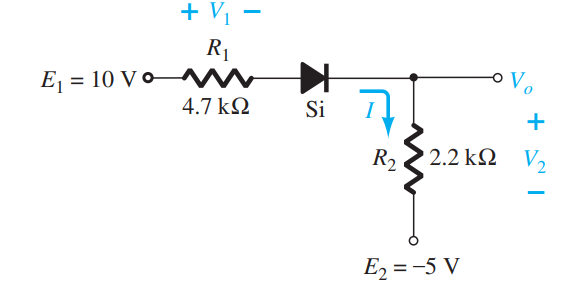
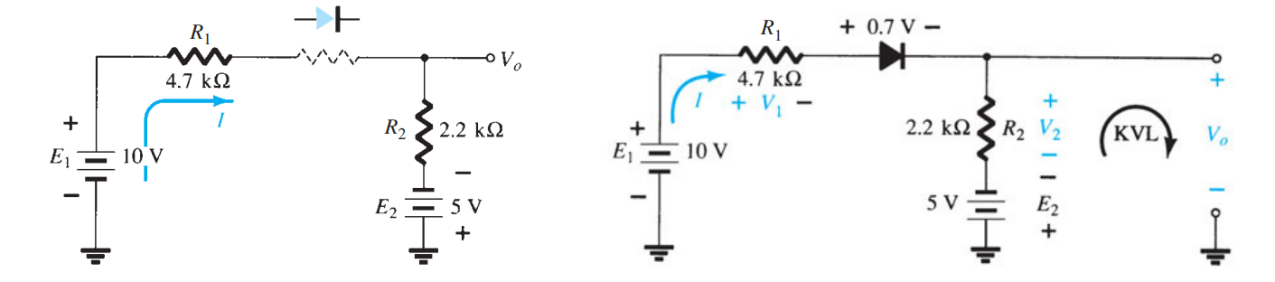
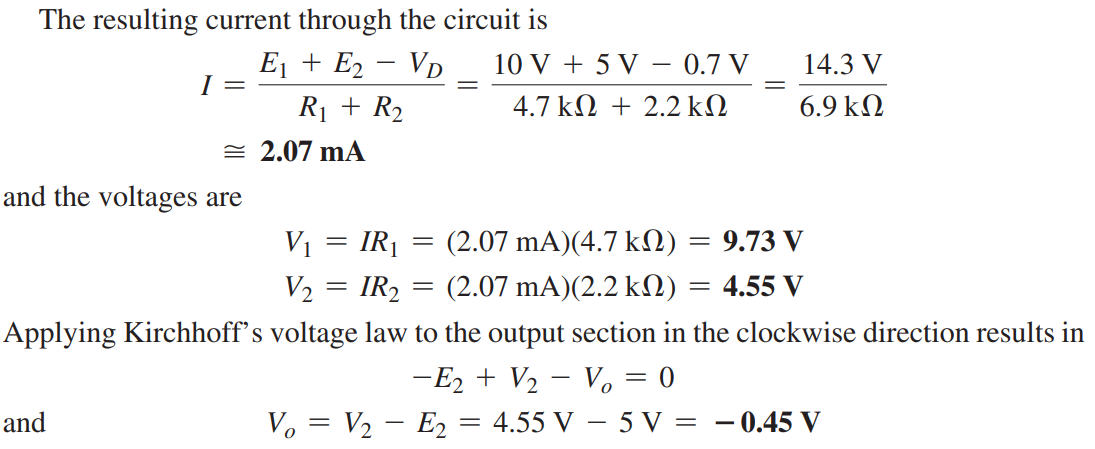


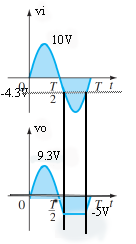
Figure 1

**Solution:**

**(a)**





The minus sign indicates that Vo has a polarity opposite to that of appearing in Fig 1.

(b)

**Problem 2**

Determine and sketch the output waveform for the network of Fig. 2 and calculate the output dc level (VDC) and the required PIV of each diode. In addition, determine the maximum current (Imax) through each diode.

A diagram of a diagram

Description automatically generated with medium confidence

Figure 2

Figure 2

**A diagram of a function

Description automatically generatedSolution:**

VDC = 0.636 x -98.6 V = -62.71 V

Imax = 98.6V/2.2KΩ = 44.81 mA

**Problem 3**

In the following network, there are two LEDs that can be used as polarity detectors. Apply a positive source voltage and a green light results. Negative supplies result in a red light.

1. Find the resistor R to ensure a current of 20 mA through the “on” diode for the configuration of Fig. 3. Note that both diodes have a reverse breakdown voltage of 3 V and an average turn-on voltage of 2 V.
2. Analyze the network if the green diode were to be replaced by a blue diode. Include appropriate figures for the analysis. Note that the forward bias required to turn on a blue diode is about 5 V.

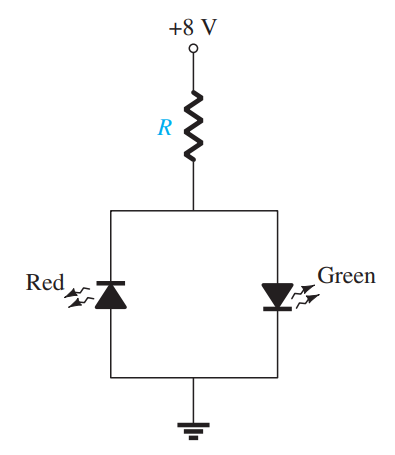
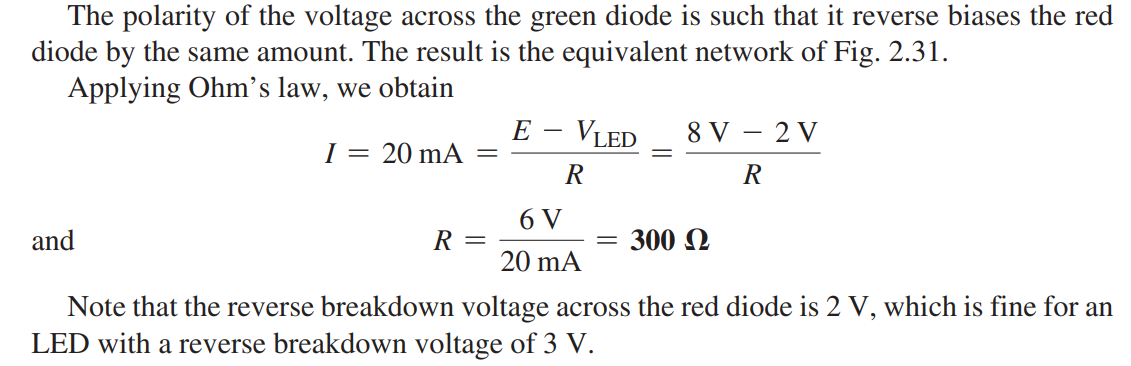
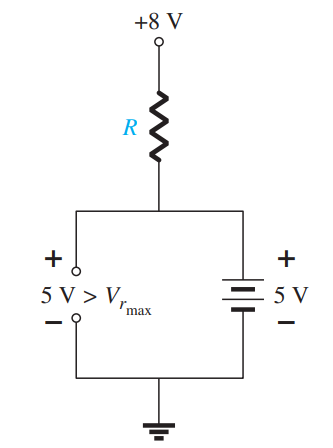


Figure 3

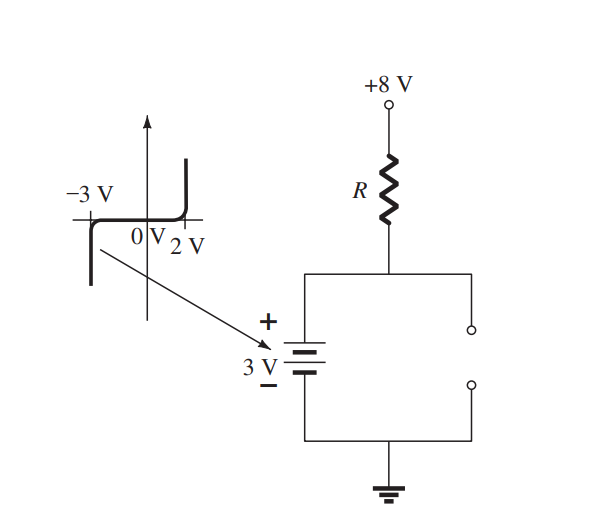
**Solution:**



1. If the green diode were to be replaced by a blue diode, problems would develop, as shown in the following Fig.



Recall that the forward bias required to turn on a blue diode is about 5 V. The result would appear to require a smaller resistor R to establish a current of 20 mA. However, note that the reverse bias voltage of the red LED is 5 V, but the reverse breakdown voltage of the diode is only 3 V. The result is the voltage across the red LED would lock in at 3 V as shown in the following Fig. The voltage across R would be 5 V and the current limited to 20 mA with a 250-ohm resistor but neither LED would be on.



**Problem 4**

1. Prove that the voltage across the capacitor of the network in Figure 4 for the input indicated, during the discharging time does not discharge significantly.
2. For the network below: determine and sketch Vo for the input indicated.
3. Find the change in output if the diode is a silicon diode.

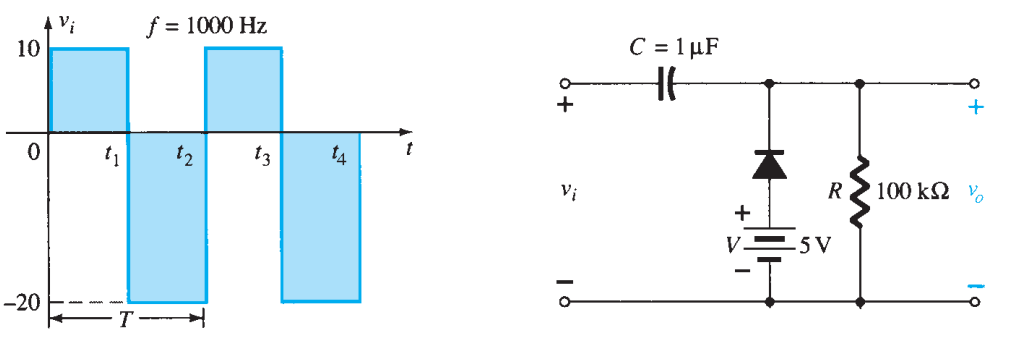
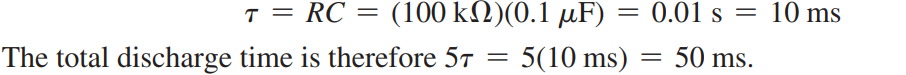


Figure 4

**Solution:**

1. T=1/f = 1/1000 Hz = 1 ms, T/2= 0.5 ms is the discharging time.



So the capacitor only discharge 10% during the discharge time

1. For the time period t1 to t2,

A math equations and symbols

Description automatically generated with medium confidence

For the time period t2 to t3,

A number symbols and signs

Description automatically generated with medium confidence

A diagram of a rectangle with numbers and lines

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1. If the diode is considered as silicon diode,

A math equations and numbers

Description automatically generated with medium confidence

For the period t2 to t3,

A number and equal sign

Description automatically generated with medium confidence

A diagram of a voltage

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**Problem 5**

For the characteristics of Fig.5 :

(a). Determine the ac resistance at ID  = 2 mA.

(b). Determine the ac resistance at ID  = 25 mA.

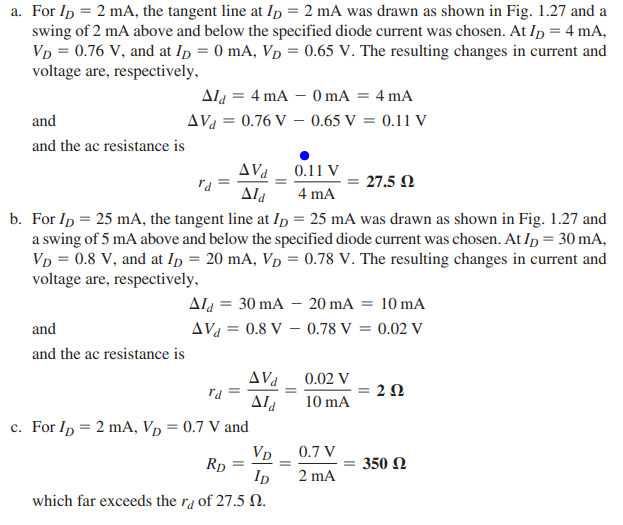
(c). Compare the results of parts (a) and (b) to the DC resistances at each current level.

A graph of a function

Description automatically generated

Figure 5

**Solution:**



A math equations with numbers and symbols

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**Problem 6**

Using the characteristics of Fig. 6b , determine ID and VD for the circuit of Fig. 6a .

b. Repeat part (a) with R = 0.47 kΩ

c. Repeat part (a) with R = 0.68 kΩ

d. Is the level of VD relatively close to 0.7 V in each case?

How do the resulting levels of ID compare? Comment accordingly.

A diagram of a circuit

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A graph paper with a grid

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Figure 6