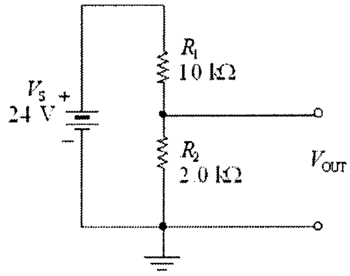
Faculty of Computers & Informatics **Electronics (BSC127)**
Benha university **Final-Term Exam(corrective)**
Semester: February/ June 2016 **Date: 24/5/2016**
Examiner: Dr Hossam Labib Zayed **Time: 3 Hours**

Answer the following questions:

Q1:Chose the correct answer :

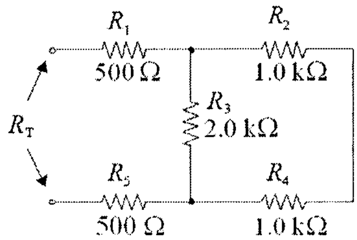
1. If the current in a 330 Ω resistor is 15 mA, the applied voltage is approximately is
   a. 5.0 V b. 22 V c. 46 V d. 60 V

2. The output voltage from the voltage divider is
   a. 2 V
   b. 4 V
   c.12 V
   d. 20 V

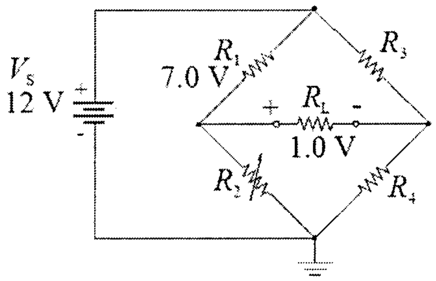


3. In a closed loop, the algebraic sum of all voltages (both sources and drops)
   a. is 0 b. is equal to the smallest voltage in the loop
   c. is equal to the largest voltage in the loop d. depends on the source voltage

4. The total resistance, R_T, of the group of resistors is
   a. 1.0 kΩ
   b. 2.0 kΩ
   c. 3.0 kΩ
   d. 4.0 kΩ



5. An unbalanced Wheatstone bridge has the voltages shown. The voltage across R_4 is
   a. 4.0 V
   b. 5.0 V
   c. 6.0 V
   d. 7.0 V



6. If a 0.015 μF capacitor is in series with a 6800 pF capacitor, the total capacitance is

   a. 1568 pF b. 4678 pF c. 6815 pF d. 0.022 μF

7. Maximum power is transferred from a fixed source when
a. the load resistor is ½ the source resistance b. the load resistor is equal to the source resistance
   c. the load resistor is twice the source resistance d. none of the above

8. When forward biased, a diod
   a. blocks current b. conducts current c. has a high resistance d. drops a large voltage

9. The output frequency of the half wave rectifier is ……the input frequency.
   a. half b. same c. twice d. quadrupl

10. The average value of a half wave rectifier voltage with a peak value of 100 is
   a. 100/π b. 200/π c. 50/π d. 300/π

Q2(a) Determine the current through a 200- μF capacitor whose voltage is shown in Fig.(1).

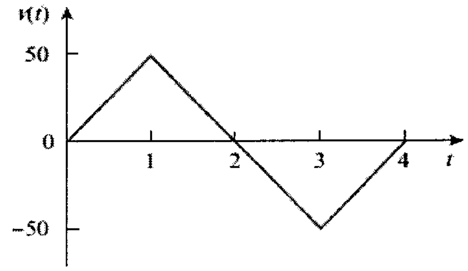


Fig.(1)

(b) Find the equivalent inductance L_{eq} seen between terminals a and b of the circuit shown in Fig. (2).

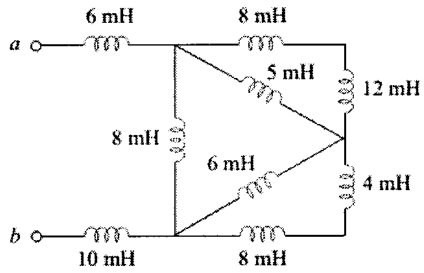


Fig.(2)

Q3 Use the node-voltage method to find the branch currents i_a, i_c, and i_e in the circuit shown in Fig.(3).

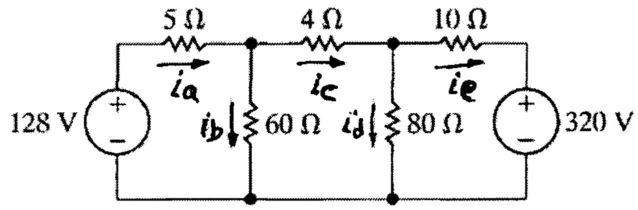


Fig.(3)

Q4 (a) Find the value of R that enables the circuit shown in Fig.(4) to deliver maximum power to the terminals a,b.

(b) Find the maximum power delivered to R.

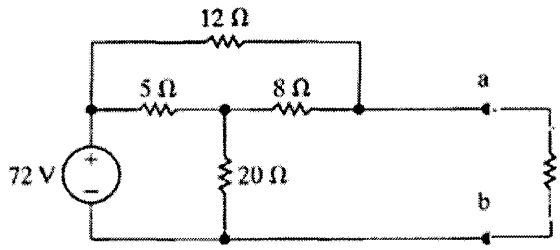


Fig.(4)

Q5 (a) Assuming that the diodes in the circuit of Fig.(5) are ideal, find the values of the labeled voltage, V, and current, I.

(b) Describe the output voltage of the circuit shown in Fig.(6). Assuming the diodes to be ideal and V_I = *10 sin wt*. Sketch one cycle of the output voltage.

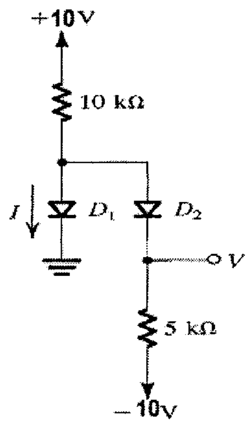


Fig.(5)

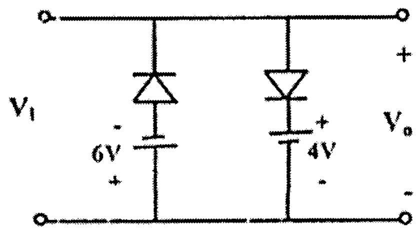


Fig.(6)

BEST WISHES

Hossam Labib

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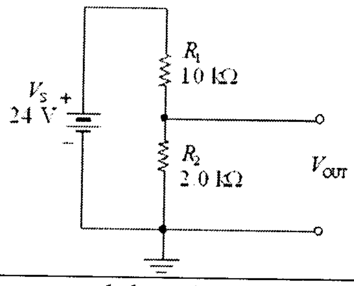
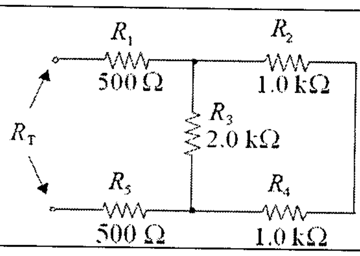


3. In a closed loop, the algebraic sum of all voltages (both sources and drops)
   a. is 0

4. The total resistance, R_T, of the group of resistors is
   b. 2.0 kΩ



5. An unbalanced Wheatstone bridge has the voltages shown.
   The voltage across R_4 is
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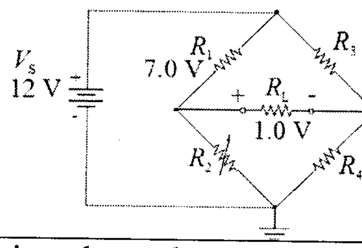

6. If a 0.015 μF capacitor is in series with a 6800 pF capacitor, the total capacitance is
   b. 4678 pF

7. Maximum power is transferred from a fixed source when
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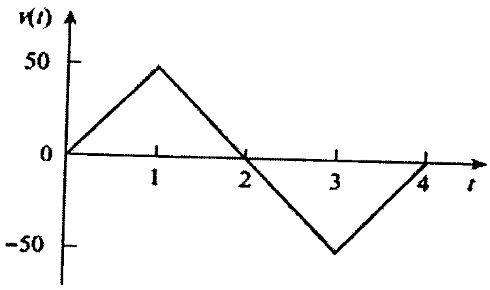
9. The output frequency of the half wave rectifier is ……the input frequency.
   b. same

10. The average value of a half wave rectifier voltage with a peak value of 100 is
    a. 100/π

Q2(a) Determine the current through a 200-μF capacitor whose voltage is shown in Fig.(1).



Solution:

The voltage waveform can be described mathematically as

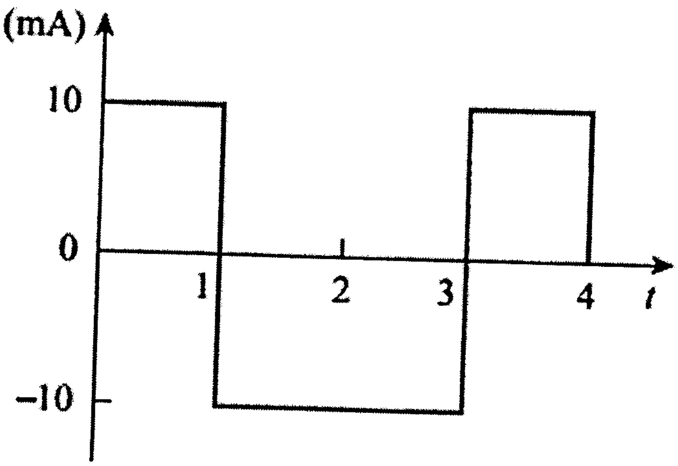
$$v(t) = \begin{cases} 50t \text{ V} & 0 < t < 1 \\ 100 - 50t \text{ V} & 1 < t < 3 \\ -200 + 50t \text{ V} & 3 < t < 4 \\ 0 & \text{otherwise} \end{cases}$$

Since $i = C\,dv/dt$ and $C = 200\ \mu$F, we take the derivative of v to obtain

$$i(t) = 200 \times 10^{-6} \times \begin{cases} 50 & 0 < t < 1 \\ -50 & 1 < t < 3 \\ 50 & 3 < t < 4 \\ 0 & \text{otherwise} \end{cases}$$

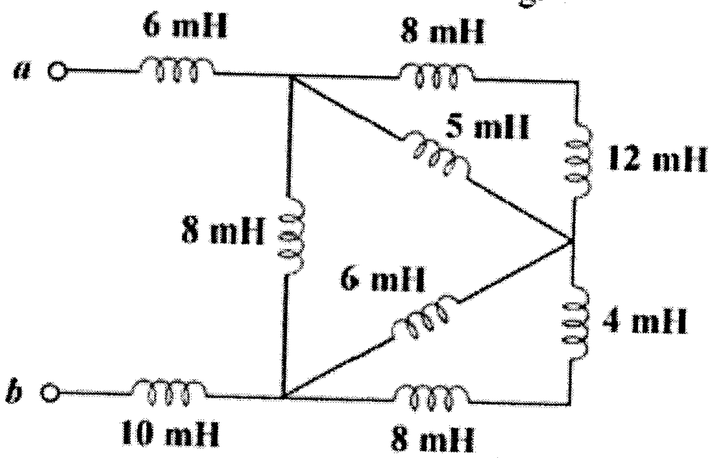
$$= \begin{cases} 10 \text{ mA} & 0 < t < 1 \\ -10 \text{ mA} & 1 < t < 3 \\ 10 \text{ mA} & 3 < t < 4 \\ 0 & \text{otherwise} \end{cases}$$

Thus the current waveform is as shown in Fig.



Q_2)(b)

Find L_{eq} at the terminals of the circuit in Fig.



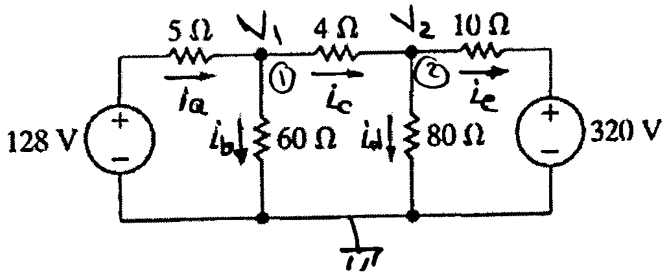
Solution

$$L_{eq} = 6 + 10 + 8 \| [5 \| (8 + 12) + 6 \| (8 + 4)]$$

$$= 16 + 8 \| (4 + 4) = 16 + 4$$

L_{eq} = **20 mH**

Q 3) Use the node-voltage method to find the branch currents i_a, i_c, and i_e in the circuit shown in Fig. 4.



Solution

at node ①

$$\left(\frac{V_1-128}{5}+\frac{V_1-V_2}{4}+\frac{V_1}{60}=0\right) \quad * 60$$

$$12V_1-1536+15V_1-15V_2+V_1=0$$

$$28V_1-15V_2=1536 \longrightarrow ①$$

at node ②

$$\left(\frac{V_2-V_1}{4}+\frac{V_2}{80}+\frac{V_2-320}{10}=0\right) \quad * 80$$

$$20V_2-20V_1+V_2+8V_2-2560=0$$

$$-20V_1+29V_2=2560 \longrightarrow ②$$

from ② $\Rightarrow V_1=\frac{29V_2-2560}{20} \longrightarrow ③$

To ① $\Rightarrow 28\left(\frac{29V_2-2560}{20}\right)-15V_2=1536$

$$40.6V_2-3584-15V_2=1536$$

$$25.6V_2=5120 \Rightarrow V_2=200\ V$$

To ③ $\Rightarrow V_1=\frac{29*200-2560}{20}=162\ V$

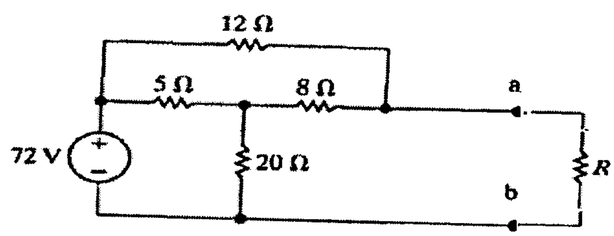
$\therefore i_a=\frac{128-V_1}{5}=\frac{128-162}{5}=-6.8\ A$

$i_c=\frac{V_1-V_2}{4}=\frac{162-200}{4}=-9.5\ A$

$i_e=\frac{V_2-320}{10}=\frac{200-320}{10}=-12\ A$

Q4 (a) Find the value of R that enables the circuit shown in Fig.(4) to deliver maximum power to the terminals a,b.

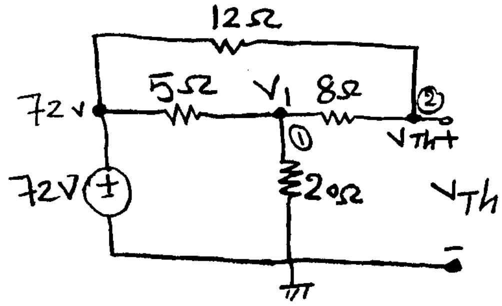
(b) Find the maximum power delivered to R.



Solution:

1ST find Thevenin equivalent circuit with respect To Terminal a,b

To find V_{Th}



at node ①

$$\frac{V_1-72}{5}+\frac{V_1}{20}+\frac{V_1-V_{Th}}{8}=0 \quad *20$$

$$4V_1-288+V_1+2.5V_1-2.5V_{Th}=0$$

$$7.5V_1-2.5V_{Th}=288 \longrightarrow ①$$

at node ②

$$\frac{V_{Th}-V_1}{8}+\frac{V_{Th}-72}{12}=0 \quad *12$$

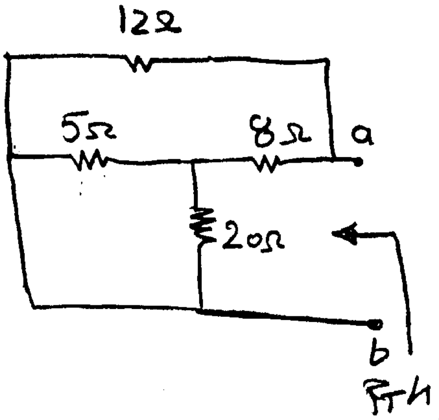
$$1.5V_{Th}-1.5V_1+V_{Th}-72=0$$

$$2.5V_{Th}-1.5V_1=72 \longrightarrow ②$$

① + ② $\Rightarrow$ $6V_1=360 \Rightarrow V_1=60\,V$

To ② ∴ $V_{Th}=\frac{72+1.5*60}{2.5}=64.8\,V$

To find R_{Th}

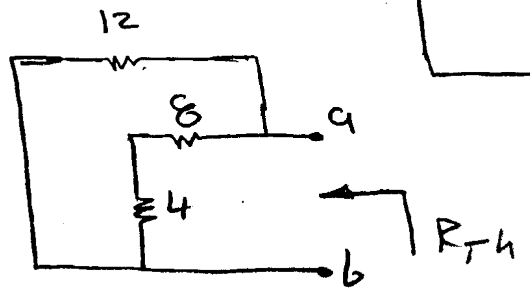


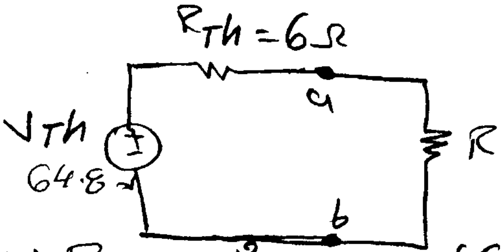
reduce DC source $\Rightarrow$ V.S = S.C

$5 \,//\, 20 = 4\Omega$

$R_{Th}=(4+8)\,//\,12$

$= 12 \,//\, 12 = 6\Omega$





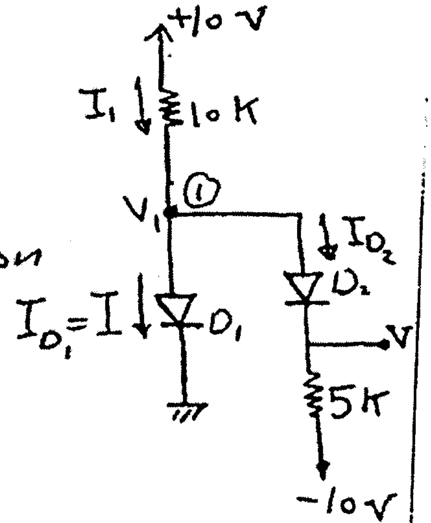
(a) for max. power $\Rightarrow R_L=R_{Th}$

∴ $R=6\Omega$

(b) $P_L\big|_{max}=\frac{V_{Th}^2}{4R_L}=\frac{(64.8)^2}{4\times6}=174.96\,W$

Q5 (a) Assuming that the diodes in the circuit of Fig.(5) are ideal, find the values of the labeled voltage, V, and current, I.

Solution



let $I = I_{D_1}$

let D_1 and D_2 are on

For D_1 on $\Rightarrow V_1 = 0 \Rightarrow V = 0$ for D_2 on

$\therefore I_1 = \frac{10 - V_1}{10K} = \frac{10-0}{10K} = 1mA$

$I_{D_2} = \frac{V_1 - (-10)}{5K} = \frac{0+10}{5K} = 2mA$

From node ① $\Rightarrow I_1 = I_{D_1} + I_{D_2}$

$I_{D_1} = I_1 - I_{D_2} = 1mA - 2mA = -1mA$

$\because I_{D_1}$ -ve $\therefore$ NoT True

i.e The assumption not correct

Let D_1 off and D_2 on

. For D_1 off $\Rightarrow I_{D_1} = 0$; $I_1 = I_{D_2}$

- For D_2 on $\Rightarrow I_1 = \frac{10-(-10)}{10K + 5K} = \frac{20}{15K} = 1.333 mA$

$V = I_{D_2} * 5K - 10 = 1.333 * 5 - 10 = -3.335 V$

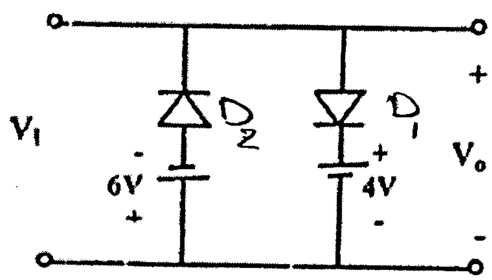
For $V = -3.335 V$; $\because V_1 = V = V_{p1} = -3.335$; $V_{n_1} = 0$

i.e $V_{P_1} < V_{n_1} \Rightarrow D_1$ off

$\therefore$ The assumption is True (D_1 off & D_2 on)

$\therefore V = -3.335 V$ and $I = I_{D_1} = 0 A$

Q5(b) Describe the output voltage of the circuit shown in Fig.(6). Assuming the diodes to be ideal and $V_I = 10 \sin wt$. Sketch one cycle of the output voltage.



Solution:

* for +ve half cycle.

- for $v_i < 4$

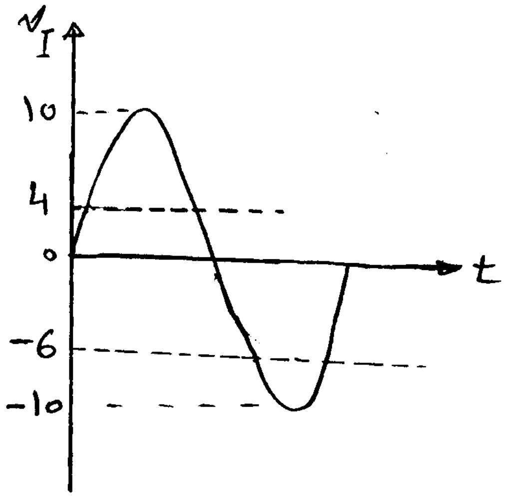
  ∴ D_1 and D_2 are off

  ∴ $v_o = v_i$

- for $v_i > 4$

  D_1 on and D_2 off

  ∴ $v_o = 4$ V



* for -ve half cycle

- for $v_i > -6$

  D_1 off and D_2 off

  ∴ $v_o = v_i$

- for $v_i < -6$

  D_1 off and D_2 on

  ∴ $v_o = -6$ V