Shahjalal University of Science and Technology
Department of Electrical & Electronic Engineering
1^{st} Year 1^{st} Semester Final Examination, 2022
Course Code: EEE 07131121, Session: 2020-2021
Course Title: Basic Electrical and Electronic Circuit

Total Marks: 60 **Credits: 3.0** **Total Time: 3 Hours**

*[Answer **all** the questions. The figure in the right margin indicate full marks.]*

Part-A

1. (a) If you want to put two or more figures side by side then you can use the latex minipage environment.What is super Node? What is the difference between Super Mesh & Mesh? 2

Solution:

(b) Using nodal analysis, determine the potential across the 4 Ω resistor in Fig. 1 4

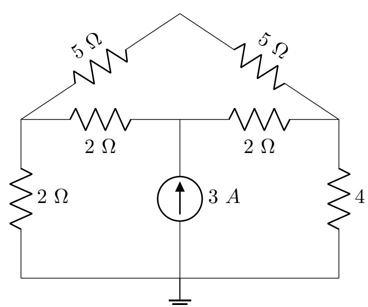

Fig. 1

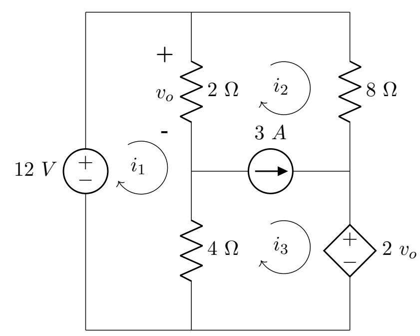

Fig. 2

Solution:

(c) Use mess analysis to find currents and voltage v_o in the circuit of Fig. 2 4

Solution:

2. (a) State Thevenin's Theorem. 1

Solution:

(b) Two resistors of values 1 kΩ and 4 kΩ are connected in series across a constant voltage supply of 100 V. A voltmeter having an internal resistance of 12 kΩ is connected across the 4 kΩ resistor. Draw the circuit and calculate: 4

(i) True voltage across 4 kΩ resistor before the voltmeter was connected.

(ii) Actual voltage across 4 kΩ resistor after the voltmeter is connected and voltage recorded by the voltmeter.

(iii) change in supply current when voltmeter is connected.

(iv) Percentage error in voltage across 4 kΩ resistor.

Solution:

(c) If you want to insert a Figure(pdf, png, etc) then you can use the **includegraphics** command as shown below. : Find the rms value of the current waveform of Fig.3. If the current flows through a 9 Ω resistor, calculate the average power absorbed by the resistor. 5

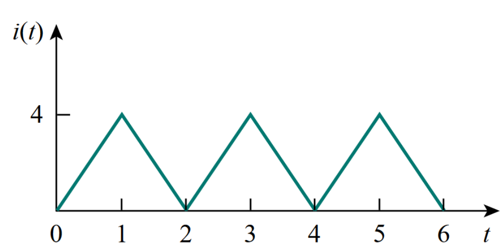

Fig. 3

Solution:

3. (a) If you want to place two figures side by side then use minipage environment. As for example: For the circuit shown in Fig. 4, calculate the current in the 10 Ω resistance. Use Thevenin's theorem only. 4

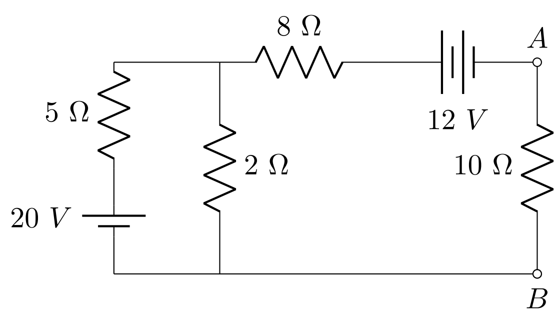

Fig. 4: Circuit for Thevenin's Theorem

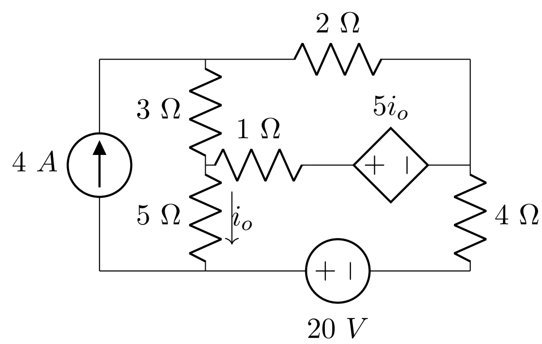

Fig. 5: Circuit for Superposition Theorem

Solution:

(b) What is super position theorem? Find i_o in the circuit in Fig. 5 using the superposition theorem. 4

Solution:

(c) If a table is needed to insert, then you can use either tabular or tabulrx. In the table as shown in Table 1, the data are given for a general purpose Silicon diode, draw the I-V characteristic curve. 2

Table 1: Your Table Title Here

SL.no	Forward bias voltage (V)	Forward bias current(mA)
1	0	0
2	0.2	0.0
3	0.4	0.1
4	0.5	0.5
5	0.53	1.0
6	0.6	8.2
7	0.66	19.5
8	0.7	53.5
9	0.71	83.1
10	0.73	112.7

Solution:

OR

(a) Find the Thevenin's equivalent circuit of Fig. 6 to the left of the terminal. 4

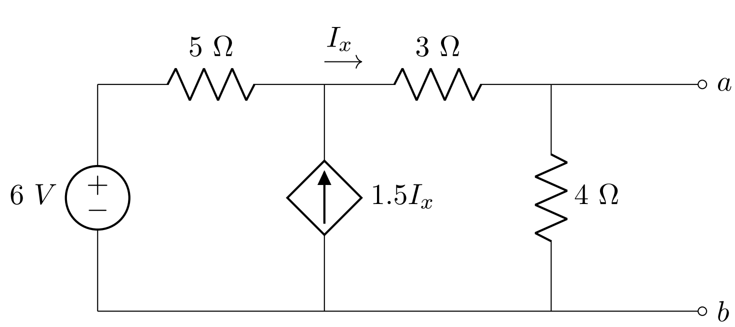

Fig. 6

Solution:

(b) Find the magnitude R_L for the maximum power transfer in the circuit shown in Fig. 7. Also find out the maximum power. 4

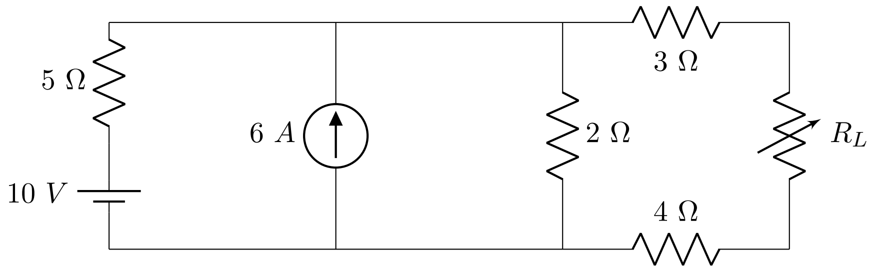

Fig. 7

Solution:

(c) Write short notes on Real power and Reactive power. 2

Solution:

Part-B

4. (a) Determine I_{BQ}, I_{CQ}, V_{CEQ}, V_B, V_C and V_{BC} for the fixed-bias configuration shown in Fig. 8. 4

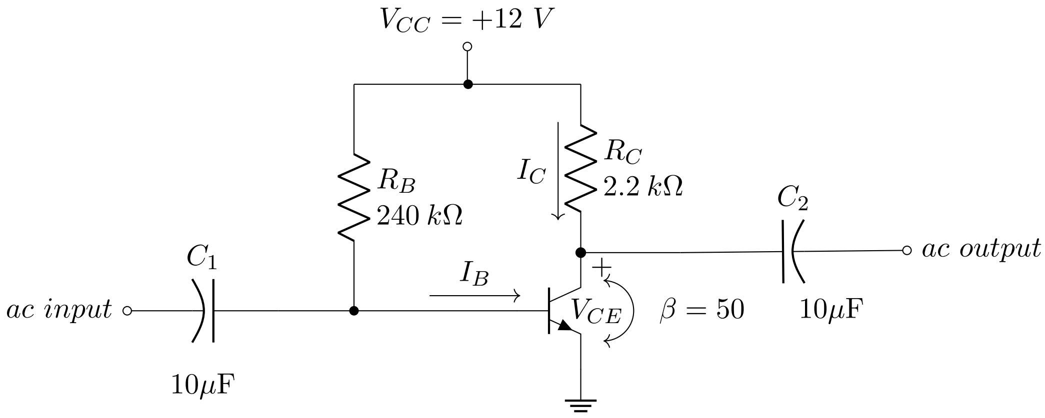

Fig. 8

Solution:

(b) Determine the saturation level for the network of Fig. 8. 2

Solution:

(c) For the emitter bias network of Fig. 9 determine I_B, I_C, V_{CE}, V_C, V_E and V_B for the fixed-bias configuration shown in 4

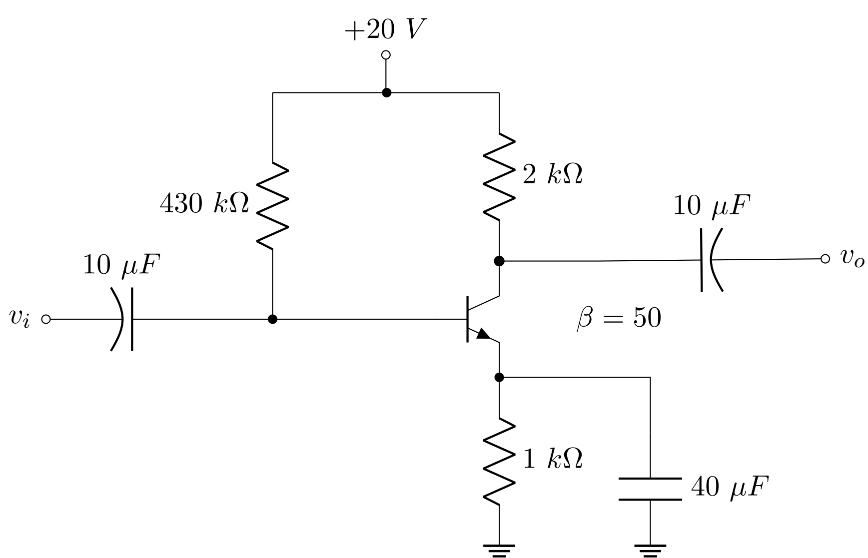

Fig. 9

Solution:

5. (a) For the circuit in Fig. 10, $i(t) = 4(2 - e^{-10t})$ mA. If $i_2(t) = -1$ mA, find: (i) $i_1(t)$, (ii) $v(t)$, $v_1(t)$ and $v_2(t)$, and (iii) $i_1(t)$ and $i_2(t)$. 4

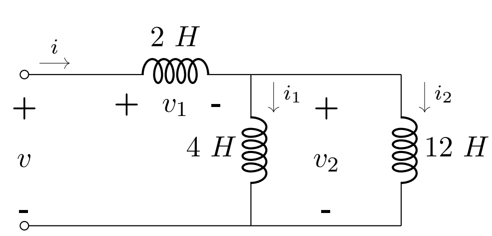

Fig. 10

Solution:

(b) Find i_x in the circuit of Fig. 11 using nodal analysis. 3

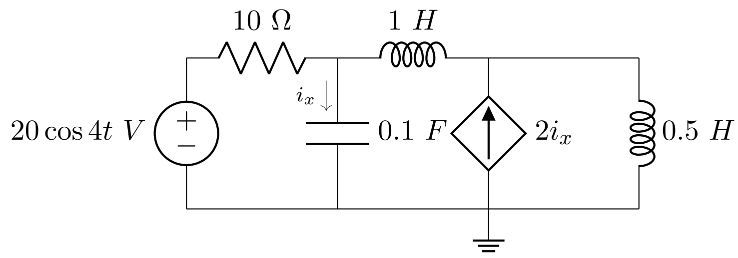

Fig. 11

Solution:

(c) Determine the currents I_1, I_2 and I_{D2} for the network of Fig. 12. 3

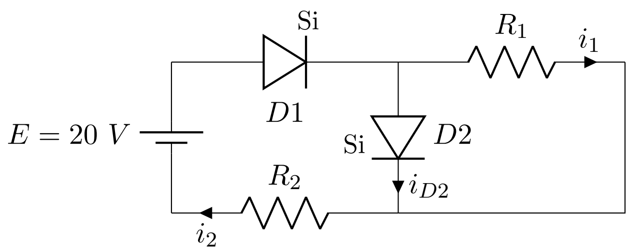

Fig. 12

Solution:

6. (a) Simplify the Boolean function $F(w,x,y,z) = \sum(1,3,7,11,15)$. Which has don't-care condition: $d(w,x,y,z) = \sum(0,2,5)$. 4

Solution:

(b) Simplify $F(A,B,C,D) = \sum(0,1,2,5,8,9,10)$ in product of sums. 4

Solution:

(c) Define Minterms and Maxterms and briefly explain De Morgan's law. 2

Solution:

OR

(a) Simplify the Boolean function $F(w,x,y,z) = \sum(0,1,2,4,5,6,8,9,12,13,14)$. 4

Solution:

(b) Suppose you have 3 friends. Design an alarm which will ring when more than one friend come. 4

Solution:

(c) Draw the symbol and truth table of EX-OR gate & EX-NOR gate. 2½

Solution:

List of the relevant equations:

$$\begin{bmatrix} A_r \\ A_\theta \\ A_\phi \end{bmatrix} = \begin{bmatrix} \sin\theta\cos\phi & \sin\theta\sin\phi & \cos\theta \\ \cos\theta\cos\phi & \cos\theta\sin\phi & -\sin\theta \\ -\sin\phi & \cos\phi & 0 \end{bmatrix} \begin{bmatrix} A_x \\ A_y \\ A_z \end{bmatrix}$$

$$\nabla \times \mathbf{A} = \frac{1}{r\sin\theta} \begin{vmatrix} \hat{r} & r\hat{\theta} & r\sin\theta\hat{\phi} \\ \dfrac{\partial}{\partial r} & \dfrac{\partial}{\partial \theta} & \dfrac{\partial}{\partial \phi} \\ A_r & rA_\theta & r\sin\theta A_\phi \end{vmatrix}$$

$$= \frac{1}{r\sin\theta}\left[\hat{r}\left(\frac{\partial}{\partial\theta}\big(\sin\theta A_\phi\big) - \frac{\partial A_\theta}{\partial\phi}\right) + \hat{\theta}\left(\frac{1}{\sin\theta}\frac{\partial A_r}{\partial\phi} - \frac{\partial}{\partial r}(rA_\phi)\right) + \hat{\phi}\left(\frac{\partial}{\partial r}(rA_\theta) - \frac{\partial A_r}{\partial\theta}\right)\right]$$

$$\begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix} = \begin{bmatrix} \sin\theta\cos\phi & \cos\theta\cos\phi & -\sin\phi \\ \sin\theta\sin\phi & \cos\theta\sin\phi & \cos\phi \\ \cos\theta & -\sin\theta & 0 \end{bmatrix} \begin{bmatrix} a_r \\ a_\theta \\ a_\phi \end{bmatrix}.$$