

**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

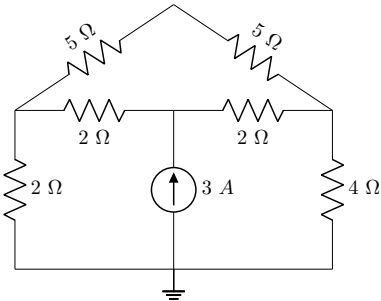


Fig. 1

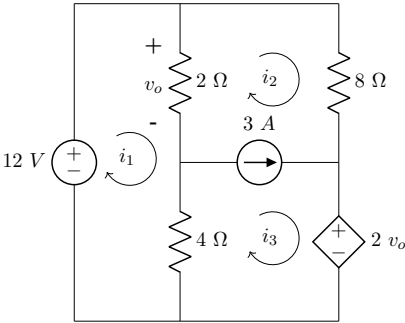


Fig. 2

**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

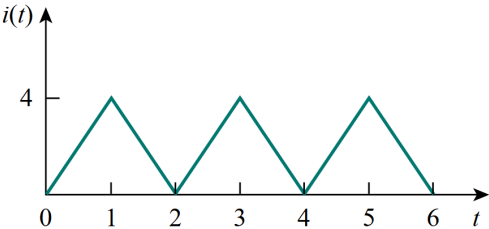


Fig. 3

**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  $10\ \Omega$  resistance. Use Thevenin's theorem only.
- 4

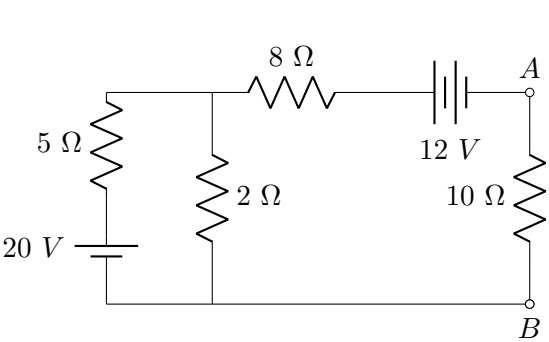


Fig. 4: Circuit for Thevenin's Theorem

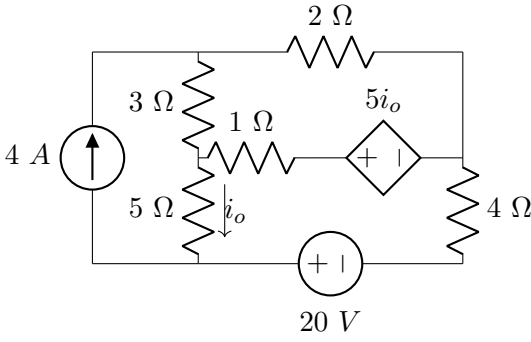


Fig. 5: Circuit for Superposition Theorem

Solution:

- (b) What is super position theorem? Find  $i_o$  in the circuit in Fig. 5 using the superposition theorem.
- 6

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

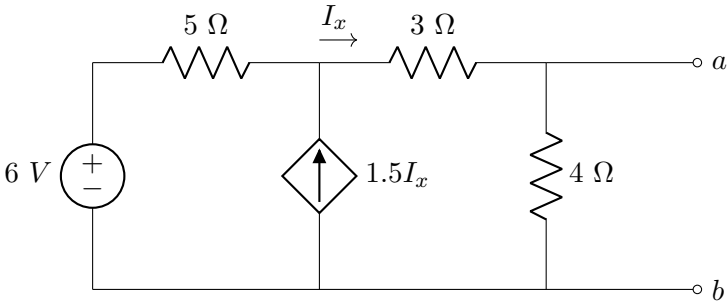


Fig. 6

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

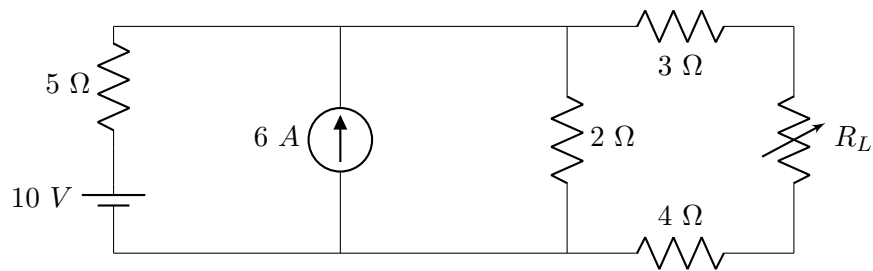


Fig. 7

**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

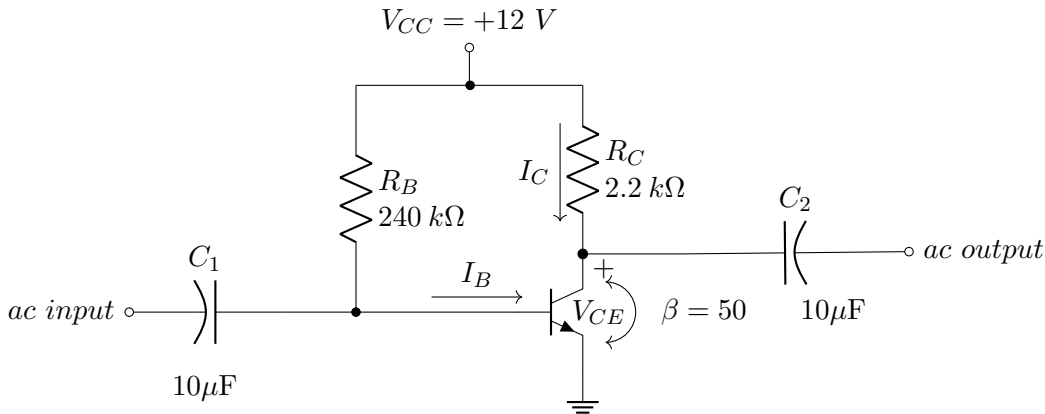


Fig. 8

**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

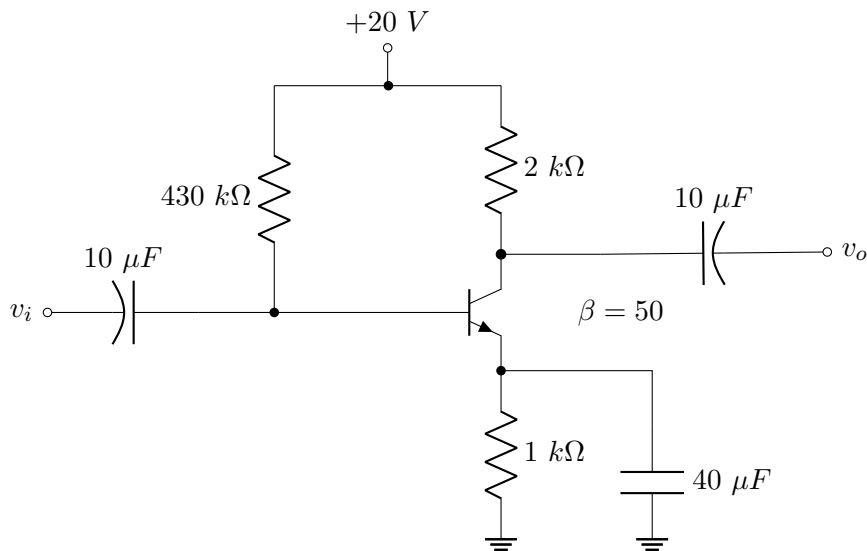


Fig. 9

**Solution:**

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

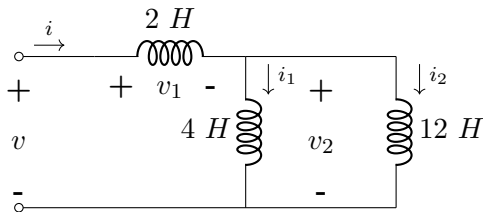


Fig. 10

**Solution:**

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

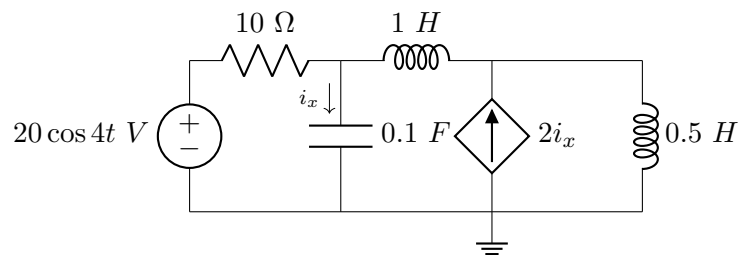


Fig. 11

**Solution:**

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

3

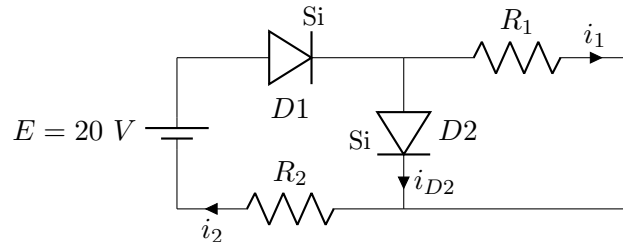


Fig. 12

**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.

$2 \times 2^{1/2}$

**Solution:**

**List of the relevant equations:**

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

$$\begin{aligned} \nabla \times \mathbf{A} &= \frac{1}{r \sin \theta} \begin{vmatrix} \hat{r} & r\hat{\theta} & r \sin \theta \hat{\phi} \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial \theta} & \frac{\partial}{\partial \phi} \\ A_r & rA_\theta & r \sin \theta A_\phi \end{vmatrix} \\ &= \frac{1}{r \sin \theta} \left[ \hat{r} \left( \frac{\partial}{\partial \theta} (\sin \theta A_\phi) - \frac{\partial A_\theta}{\partial \phi} \right) + \hat{\theta} \left( \frac{1}{\sin \theta} \frac{\partial A_r}{\partial \phi} - \frac{\partial}{\partial r} (r A_\phi) \right) \right. \\ &\quad \left. + \hat{\phi} \left( \frac{\partial}{\partial r} (r A_\theta) - \frac{\partial A_r}{\partial \theta} \right) \right] \end{aligned}$$

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