

Practice Book  
*for*  
**GENCO,  
TRANSCO & DISCOMs**

# Electrical Engineering

Technical Section

Non-Technical Section

*Including* Previous Solved Papers of  
AP, TS : GENCO and TRANSCO



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## **Practice Book for GENCO, TRANSCO & DISCOMs: Electrical Engineering**

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# Preface

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**GENCO, TRANSCO & DISCOMs** has been always preferred by engineers due to job stability and opportunity to work in their home state. This examination is conducted from time to time but not every year. MADE EASY team has made deep study of previous exam papers and observed that a good percentage of questions are of repetitive in nature, therefore previous years papers are advisable to solve before a candidate takes the exam. This book is useful for all power generation, transmission and distribution companies, state engineering services and other competitive exams for engineering graduates.



**B. Singh** (Ex. IES)

This edition of the book is prepared with due care to provide complete solutions to all questions with accuracy. I would like to give credit of publishing this book to MADE EASY Team for their hard efforts in collecting practice questions & solving previous years papers of AP, TS : GENCO and TRANSCO.

I have true desire to serve student community by providing good source of study and quality guidance. I hope this book will be proved an important tool to succeed in GENCO, TRANSCO and DISCOMs as well as other competitive exams. Any suggestions from the readers for improvement of this book are most welcome.

With Best Wishes

**B. Singh**

CMD, MADE EASY

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## Practice book for GENCO, TRANSCO & DISCOMs

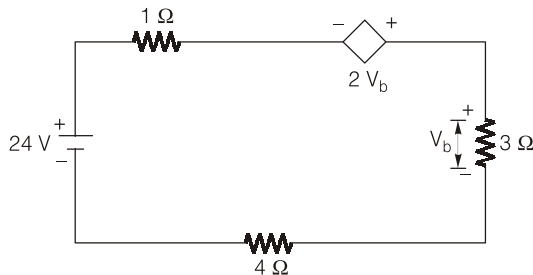
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# 1

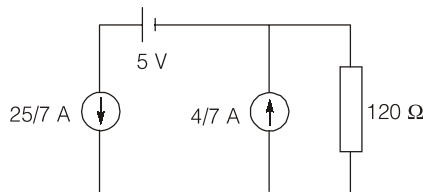
## Electrical Circuits

- Q.1** The current in the given circuit with a dependent voltage source is



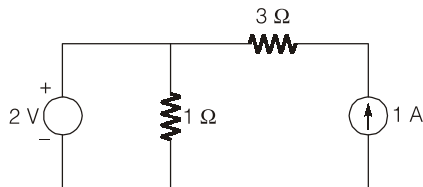
- (a) 10 A  
(b) 12 A  
(c) 14 A  
(d) 16 A

- Q.2** The current through 120 ohm resistor in the circuit shown in the figure below is



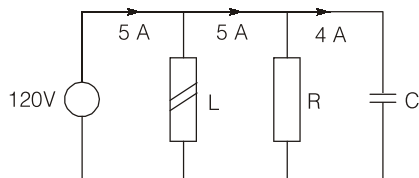
- (a) 1 A  
(b) 2 A  
(c) 3 A  
(d) 4 A

- Q.3** For the circuit given in figure below the power delivered by the 2 volt source is given by



- (a) 4 W  
(b) 2 W  
(c) -2W  
(d) -4W

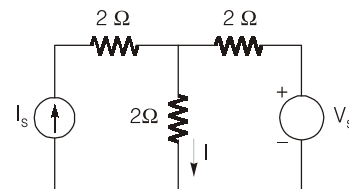
- Q.4** In the circuit shown in the given figure,



The current through the inductor L is

- (a) 0 A  
(b) 3 A  
(c) 4 A  
(d) 8 A

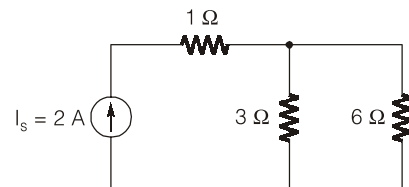
- Q.5** For the circuit shown below, the value of  $V_s$  is 0 when  $I = 4$  A. The value of  $I$  when  $V_s = 16$  V, is



- (a) 6 A  
(b) 8 A  
(c) 10 A  
(d) 12 A

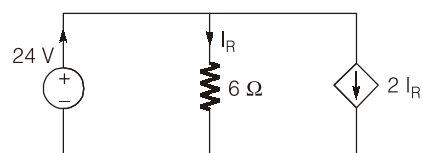
- Q.6** In a network made up of linear resistors and ideal voltage sources, values of all resistors are doubled. Then the voltage across each resistor is
- (a) Doubled  
(b) Halved  
(c) Decreases four times  
(d) Not changed

- Q.7** For the circuit shown below, what is the voltage across the current source  $I_s$  ?



- (a) 0  
(b) 2 V  
(c) 3 V  
(d) 6 V

- Q.8** Consider the circuit in the below figure. What is the power delivered by the 24 V source?



- (a) 96 W                      (b) 144 W  
(c) 192 W                    (d) 288 W

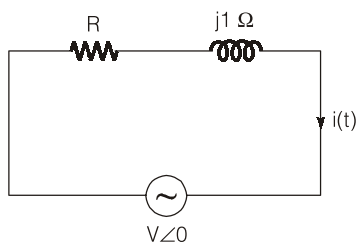
**Q.9** Consider the following statements on mesh and nodal analysis:

1. Networks that contain many series-connected elements, voltage sources or meshes having common current sources (super meshes) are more suitable for mesh analysis than for nodal analysis.
2. Networks with parallel connected elements, current sources or nodes connected by voltage sources are more suitable for nodal analysis than mesh analysis.
3. A circuit with fewer nodes than meshes is better analyzed using mesh analysis, while a circuit with fewer meshes, than nodes is better analyzed using nodal analysis.

Which of the statements given above are correct?

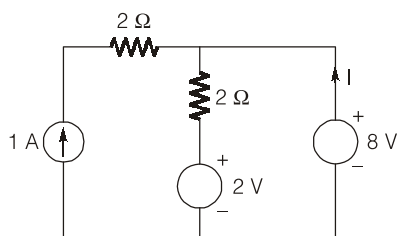
- (a) 1 and 2                    (b) 2 and 3  
(c) 1 and 3                    (d) 1, 2 and 3

**Q.10** For the network shown below, if the current  $i(t) = \sqrt{2} \sin(\omega t - 30^\circ)$ , then what is the value of  $R$ ?



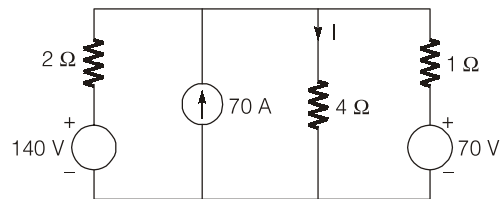
- (a)  $1 \Omega$                       (b)  $3 \Omega$   
(c)  $\sqrt{3} \Omega$                     (d)  $3\sqrt{3} \Omega$

**Q.11** In the circuit shown below, what is the value of the current  $I$ ?



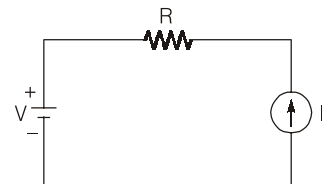
- (a) 1 A                          (b) 2 A  
(c) 3 A                          (d) 4 A

**Q.12** What is the value of the current  $I$  in the circuit shown below?



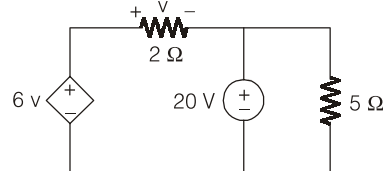
- (a) 20 A                      (b) 25 A  
(c) 30 A                      (d) 36 A

**Q.13** For the network shown in the figure below, what is the voltage across the current source?



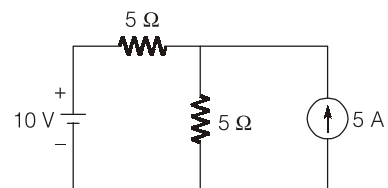
- (a)  $V - RI$                     (b)  $V + RI$   
(c) Zero                      (d)  $RI - V$

**Q.14** What is the current through the  $2 \Omega$  resistance for the circuit as shown below?



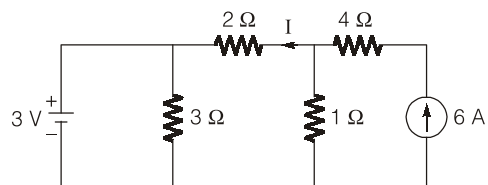
- (a) 5 A                          (b) 4 A  
(c) 3 A                          (d) 2 A

**Q.15** What is the voltage across the current source for the below shown circuit?



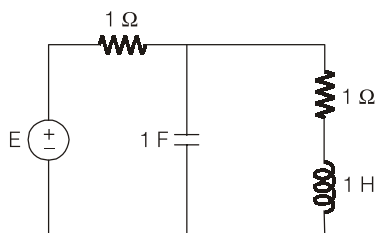
- (a) 5.0 V                      (b) 7.5 V  
(c) 12.5 V                    (d) 17.5 V

**Q.16** For the circuit as shown below, what is the value of  $I$ ?



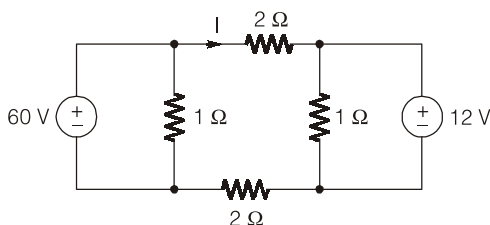
- (a) 4 A                      (b) 3 A  
(c) 2 A                      (d) 1 A

**Q.17** If the power dissipated in the circuit shown below is 8 W, then the value of E will be



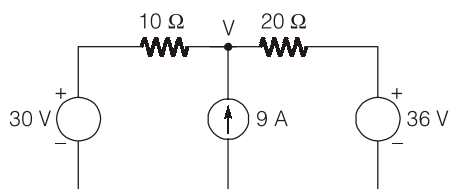
- (a) 2 V                      (b) 4 V  
(c) 8 V                      (d) 16 V

**Q.18** For the circuit shown in figure below, the value of current, I is



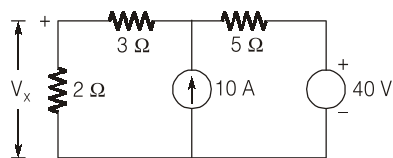
- (a) 2 A                      (b) 3 A  
(c) 6 A                      (d) 12 A

**Q.19** The node voltage V in the circuit is



- (a) 6 V                      (b) 30 V  
(c) 36 V                      (d) 92 V

**Q.20** The voltage  $V_x$  across the  $2\ \Omega$  resistance in the circuit is

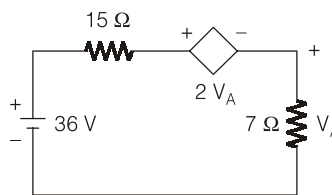


- (a) 16 V                      (b) 60 V  
(c) 18 V                      (d) 10 V

**Q.21** The number of independent KVL and KCL equations for a network with n-nodes and l links are respectively

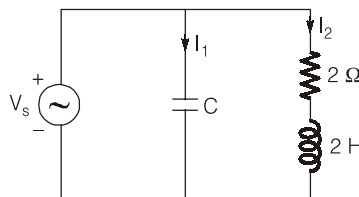
- (a) l and n                      (b) l and n - 1  
(c) n - 1 and l                      (d) n - 1 and l - 1

**Q.22** The power dissipated in the controlled source of the network shown below is



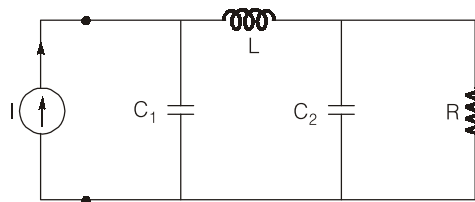
- (a) 36 W                      (b) 15 W  
(c) 07 W                      (d) 14 W

**Q.23** In the network shown below  $V_s = 4\cos 2t$ . The value of C is so chosen that the circuit impedance is maximum. Then  $I_1$  leads  $I_2$  by



- (a)  $45^\circ$                       (b)  $90^\circ$   
(c)  $0^\circ$                       (d)  $135^\circ$

**Q.24** For the circuit shown in the given figure, the current through L and the voltage across  $C_2$  are respectively

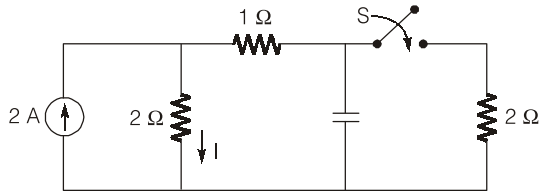


- (a) Zero and RI                      (b) I and zero  
(c) zero and zero                      (d) I and RI

**Q.25** The response of an initially relaxed system to a unit ramp excitation is  $(t + e^{-t})$ . Its step response will be

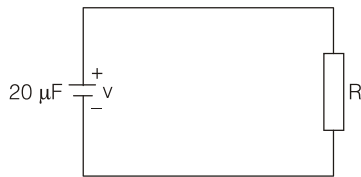
- (a)  $1/2 t^2 - e^{-t}$                       (b)  $1 - e^{-t}$   
(c)  $-e^{-t}$                       (d) t

- Q.26** The steady state in the circuit, shown in the given figure is reached with S open. S is closed at  $t = 0$ . The current  $I$  at  $t = 0^+$  is



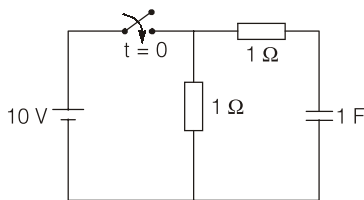
- (a) 1 A                      (b) 2 A  
(c) 3 A                      (d) 4 A

- Q.27** For the circuit shown in the given figure below, if  $C = 20 \mu\text{F}$ ,  $v(0^-) = -50 \text{ V}$  and  $dv(0^-)/dt = 500 \text{ V/s}$ , then  $R$  is



- (a) 2 kΩ                      (b) 3 kΩ  
(c) 5 kΩ                      (d) 10 kΩ

- Q.28** In the circuit shown in the given figure, the switch is closed at  $t = 0$ .

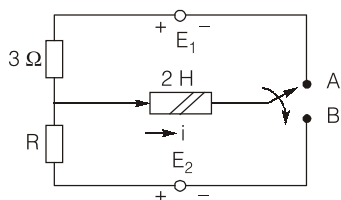


The current through the capacitor will decrease exponentially with a time constant:

- (a) 0.5 s                      (b) 1 s  
(c) 2 s                        (d) 10 s

- Q.29** In the circuit shown in the given figure, the switch is moved from position A to B at time  $t = 0$ . The current  $i$  through the inductor satisfies the following conditions :

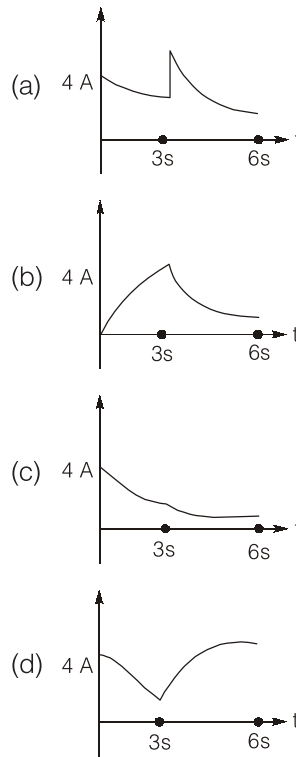
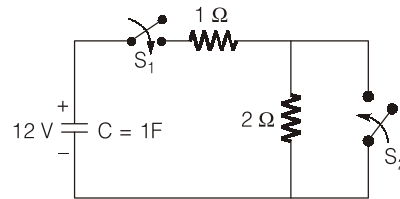
$$i(0) = -8 \text{ A}, \left. \frac{di}{dt} \right|_{t=0} = 3 \text{ A/s}, i(\infty) = 4 \text{ A}.$$



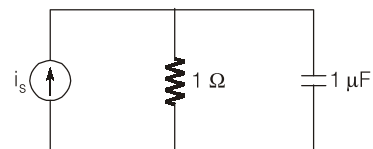
The value of  $R$  is

- (a) 0.5 ohm                      (b) 2 ohm  
(c) 4 ohm                        (d) 12 ohm

- Q.30** The capacitor in the circuit as shown below is initially charged to 12 V with  $S_1$  and  $S_2$  open.  $S_1$  is closed at  $t = 0$  while  $S_2$  is closed at  $t = 3\text{s}$ . The waveform of the capacitor is represented by

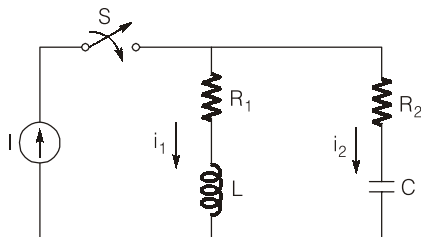


- Q.31** In the circuit shown in the figure below, if  $i_s = u(t)$  A, then what are the initial and steady-state voltages across the capacitor?



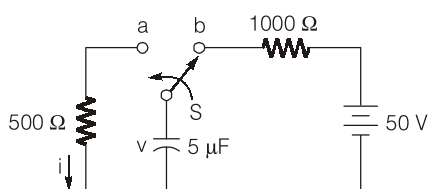
- (a) 1 V and 1 V, respectively  
(b) 1 V and 0, respectively  
(c) 0 and 1 V, respectively  
(d) 0 and 0, respectively

- Q.32** In the circuit shown below, the constant current source of value  $I$  is switched on at  $t = 0$ . What are the values of currents  $i_1$  and  $i_2$  at  $t = 0$ , with zero initial conditions?



- (a)  $I$                        $0$   
 (b)  $0$                        $I$   
 (c)  $\frac{R_2}{R_1 + R_2} I$          $\frac{R_1}{R_1 + R_2} I$   
 (d)  $0$                        $0$

- Q.33** At  $t = 0$ , the switch  $S$  is thrown from  $b$  to  $a$  of the circuit as shown below. What are the values of  $v(0^+)$  and  $i(0^+)$ ?

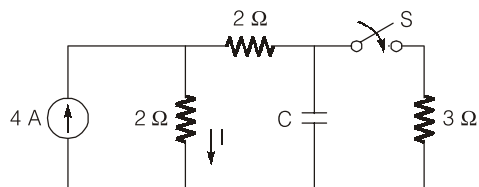


- (a) 50 V, 90 mA        (b) 50 V, 100 mA  
 (c) 50 V, 110 mA      (d) 50 V, 120 mA

- Q.34** An R-C series circuit, initially at rest has a step voltage signal. The response  $v(t)$  across  $C$  is  $v(t) = 1 - e^{-3t}$ . If now there is an initial voltage at  $C$  of 3 volts, what is  $v(t)$  for the same step signal?

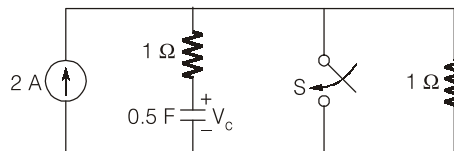
- (a)  $1 + 3e^{-3t}$         (b)  $1 + 2e^{-3t}$   
 (c)  $3e^{-3t}$               (d) None of these

- Q.35** Steady state is reached with  $S$  open.  $S$  is closed at  $t = 0$ . What is the value of the current  $I$  at  $t = 0^+$ ?



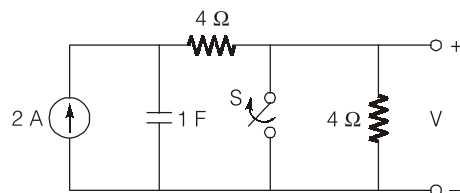
- (a) 1 A                      (b) 2 A  
 (c) 3 A                      (d) 4 A

- Q.36** The circuit shown in the figure given below is in steady state with switch  $S$  open. The switch is closed at  $t = 0$ . What are the values of  $V_c(0^+)$  and  $V_c(\infty)$ , respectively?



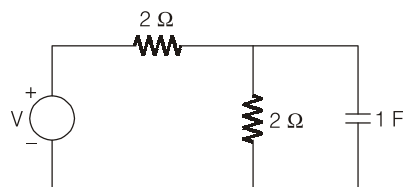
- (a) 0 V, 0 V              (b) 0 V, 2 V  
 (c) 2 V, 0 V              (d) 2 V, 2 V

- Q.37** In the below network,  $S$  is closed for a long time till steady state is attained.  $S$  is opened at  $t = 0$ . What are the values of voltage  $V$  at  $t = 0^+$  and  $t = \infty$ ?



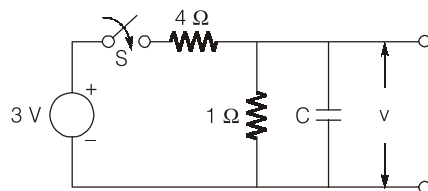
- (a) 8 V, 8 V              (b) 4 V, 8 V  
 (c) 8 V, 4 V              (d) 4 V, 4 V

- Q.38** What is the time constant of the circuit below?



- (a) 0.5 s                  (b) 1 s  
 (c) 2 s                    (d) 4 s

- Q.39** In the network shown below, it is given that  $v = 1$  V and  $dv/dt = -10$  V/s at a time  $t$ , where  $t$  is the time after the switch  $S$  is closed. What is the value of  $C$ ?



- (a) 0.05 F                (b) 0.1 F  
 (c) 0.15 F                (d) 0.2 F

**Q.40** A series R-L circuit is to be connected to an a.c. source  $v(t) = V_m \sin(\omega t + \phi)$  volt. Which one of the following is correct?

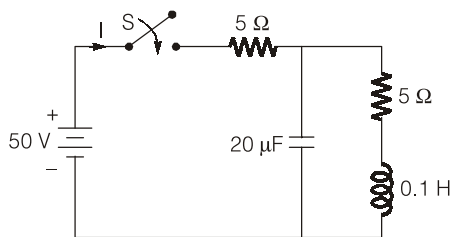
The transient current will be absent if the source is connected at a time  $t_0$  such that

- (a)  $\omega t_0 = 0$
- (b)  $\omega t_0 = \frac{\pi}{2}$
- (c)  $\omega t_0 = \tan^{-1} \frac{\omega L}{R}$
- (d)  $\omega t_0$  has any arbitrary value

**Q.41** A series R-L-C circuit is switched ON to a step voltage  $V$  at  $t = 0$ . What are the initial and final values of the current in the circuit, respectively?

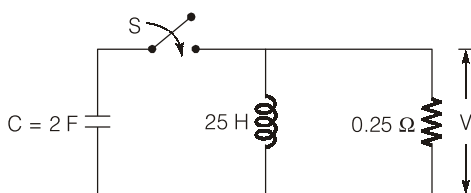
- (a)  $V/R$ ,  $V/R$
- (b) Zero, Infinity
- (c) Zero, Zero
- (d) Zero,  $V/R$

**Q.42** The network shown below is initially at rest. What is the initial current  $I$  when the switch  $S$  is closed at  $t = 0$ ?



- (a) 0 A
- (b) 5 A
- (c) 10 A
- (d) 20 A

**Q.43** For the given circuit shown in the figure below, the initial inductor current and the voltage across the capacitor are zero and 2, respectively. When the switch  $S$  is closed at  $t = 0$ , the values of  $v$  and  $dv/dt$  are, respectively



- (a) 2, -4
- (b) 0, 0.25
- (c) 0, -0.5
- (d) 2, 0

**Q.44 Statement (I):** Under steady-state conditions, a pure inductance acts as a short circuit for direct current.

**Statement (II):** The potential drop across an inductance is proportional to the rate of change of current.

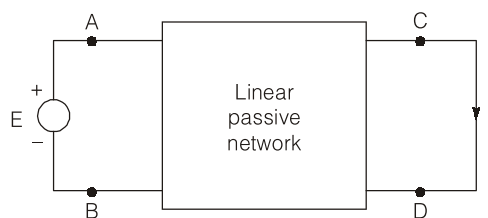
- (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
- (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I).
- (c) Statement (I) is true but Statement (II) is false.
- (d) Statement (I) is false but Statement (II) is true.

**Q.45 Assertion (A):** Norton's theorem is applied to a network for which no equivalent Thevenin's network exists.

**Reason (R):** Norton's Theorem enables one to calculate quickly current and voltage in a particular branch of interest in a complicated network.

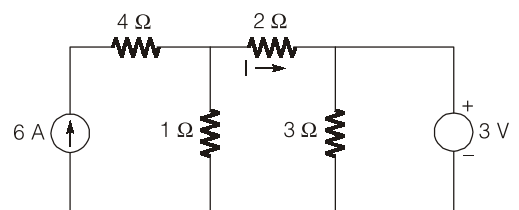
- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is NOT the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Q.46** For the circuit shown in the given figure, when the voltage  $E$  is 10 V, the current  $I$  is 1A. If the applied voltage across terminal C-D is 100 V, the short circuit current flowing through the terminal A-B will be



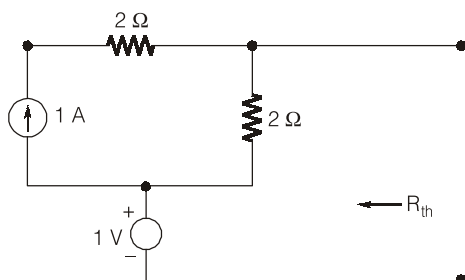
- (a) 0.1 A
- (b) 1 A
- (c) 10 A
- (d) 100 A

**Q.47** For the circuit shown in the given figure the current  $I$  is given by



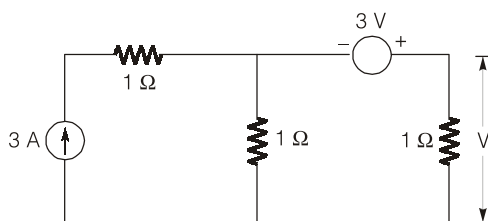
- (a) 3 A
- (b) 2 A
- (c) 1 A
- (d) zero

**Q.48** The Thevenin's equivalent resistance  $R_{th}$  for the given network is



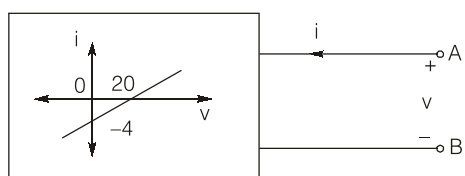
- (a)  $1 \Omega$  (b)  $2 \Omega$   
(c)  $4 \Omega$  (d) infinity

**Q.49** The value of  $V$  in the circuit shown in the given figure is



- (a) 1 V (b) 2 V  
(c) 3 V (d) 4 V

**Q.50** The resistance seen from the terminals A and B of the device whose characteristic is shown in the figure below is



- (a)  $-5 \Omega$  (b)  $-1/5 \Omega$   
(c)  $1/5 \Omega$  (d)  $5 \Omega$

**Q.51** If the combined generator and line impedance is  $(5 + j10) \Omega$ , then for the maximum power transfer to a load impedance from a generator of constant generated voltage, the load impedance is given by which one of the following

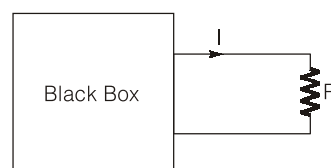
(a)  $(5 + j10) \Omega$  (b)  $(5 - j10) \Omega$   
(c)  $(5 + j5) \Omega$  (d)  $5 \Omega$

**Q.52** Superposition theorem is not applicable for

(a) voltage calculation  
(b) bilateral elements

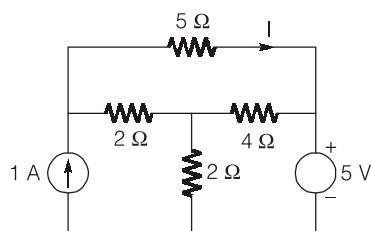
- (c) power calculation  
(d) passive elements

**Q.53** The black box as shown in the circuit below contains resistors and independent sources. For  $R = 0$  and 2, the value of current  $I$  is 3 and 1.5 respectively. The value of  $I$  for  $R = 1$  will be



- (a) 0.5 (b) 1.5  
(c) 2.0 (d) 3.0

**Q.54** Consider the following circuit :



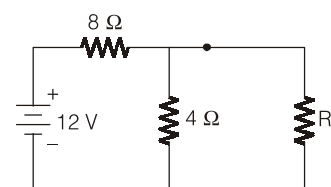
What is the value of current  $I$  in the  $5 \Omega$  resistor in the above circuit ?

- (a) 0 A (b) 2 A  
(c) 3 A (d) 4 A

**Q.55** A voltage source having an internal impedance of  $8 + j6 \Omega$  supplies power to a resistive load. What should be the load resistance for maximum power transferred to it?

(a) 8 ohms (b) 6 ohms  
(c) 10 ohms (d)  $\sqrt{10}$  ohms

**Q.56** Consider the following circuit :



What should be the value of resistance  $R$ , in the above circuit if it has to absorb the maximum power from the source ?

- (a)  $8/3$  ohms (b)  $3/8$  ohms  
(c) 4 ohms (d) 8 ohms

**Answer Key | Electrical Circuits**

1. (b)	37. (b)	73. (c)	109. (d)	145. (d)	181. (a)	217. (d)
2. (c)	38. (b)	74. (a)	110. (d)	146. (d)	182. (b)	218. (c)
3. (b)	39. (a)	75. (a)	111. (d)	147. (b)	183. (a)	219. (b)
4. (d)	40. (c)	76. (d)	112. (a)	148. (b)	184. (c)	220. (d)
5. (b)	41. (c)	77. (d)	113. (d)	149. (b)	185. (b)	221. (a)
6. (d)	42. (c)	78. (b)	114. (a)	150. (a)	186. (c)	222. (c)
7. (d)	43. (a)	79. (d)	115. (c)	151. (b)	187. (a)	223. (d)
8. (d)	44. (a)	80. (c)	116. (b)	152. (c)	188. (c)	224. (b)
9. (a)	45. (d)	81. (a)	117. (a)	153. (a)	189. (c)	225. (d)
10. (c)	46. (c)	82. (b)	118. (c)	154. (c)	190. (a)	226. (a)
11. (b)	47. (c)	83. (d)	119. (b)	155. (b)	191. (c)	227. (c)
12. (c)	48. (b)	84. (c)	120. (b)	156. (a)	192. (b)	228. (d)
13. (b)	49. (c)	85. (a)	121. (b)	157. (b)	193. (a)	229. (d)
14. (d)	50. (d)	86. (d)	122. (b)	158. (c)	194. (b)	230. (a)
15. (d)	51. (b)	87. (b)	123. (a)	159. (b)	195. (a)	231. (c)
16. (d)	52. (c)	88. (b)	124. (c)	160. (c)	196. (c)	232. (d)
17. (b)	53. (c)	89. (c)	125. (b)	161. (c)	197. (d)	233. (c)
18. (d)	54. (a)	90. (b)	126. (b)	162. (c)	198. (a)	234. (a)
19. (d)	55. (c)	91. (d)	127. (a)	163. (c)	199. (a)	235. (b)
20. (c)	56. (a)	92. (c)	128. (c)	164. (b)	200. (c)	236. (c)
21. (b)	57. (c)	93. (a)	129. (a)	165. (a)	201. (b)	237. (b)
22. (d)	58. (b)	94. (d)	130. (a)	166. (b)	202. (b)	238. (c)
23. (d)	59. (d)	95. (c)	131. (b)	167. (d)	203. (d)	239. (c)
24. (d)	60. (a)	96. (d)	132. (b)	168. (c)	204. (d)	240. (a)
25. (b)	61. (b)	97. (b)	133. (d)	169. (b)	205. (d)	241. (b)
26. (b)	62. (d)	98. (c)	134. (d)	170. (b)	206. (c)	242. (d)
27. (c)	63. (b)	99. (b)	135. (a)	171. (c)	207. (b)	243. (d)
28. (b)	64. (c)	100. (b)	136. (a)	172. (b)	208. (d)	244. (c)
29. (a)	65. (c)	101. (c)	137. (a)	173. (d)	209. (a)	245. (d)
30. (a)	66. (a)	102. (c)	138. (d)	174. (d)	210. (b)	246. (b)
31. (c)	67. (b)	103. (c)	139. (a)	175. (b)	211. (a)	247. (c)
32. (b)	68. (b)	104. (a)	140. (a)	176. (a)	212. (c)	248. (a)
33. (b)	69. (d)	105. (d)	141. (b)	177. (c)	213. (c)	
34. (b)	70. (c)	106. (b)	142. (b)	178. (b)	214. (c)	
35. (d)	71. (d)	107. (d)	143. (c)	179. (b)	215. (c)	
36. (c)	72. (c)	108. (d)	144. (b)	180. (b)	216. (a)	

## Explanations | Electrical Circuits

1. (b)

Applying KVL in the loop

$$24 - 1I + 2V_b - V_b - 4I = 0$$

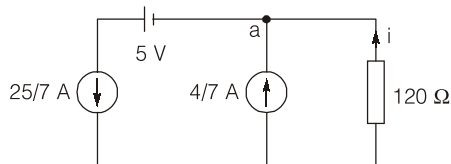
$$\text{where } V_b = 3I$$

$$\Rightarrow 24 - 5I + V_b = 0$$

$$\Rightarrow 24 - 5I + 3I = 0$$

$$I = 12 \text{ A}$$

2. (c)

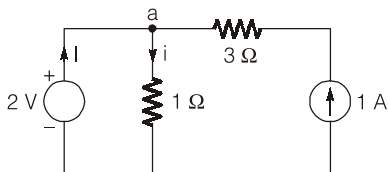


By applying KCL at node a

$$i = \frac{25}{7} - \frac{4}{7} = 3 \text{ A}$$

Voltage source in series with constant current source will behave like short circuit.

3. (b)



$$\text{From figure } i = \frac{2}{1} = 2 \text{ Amp}$$

By applying KCL at node a

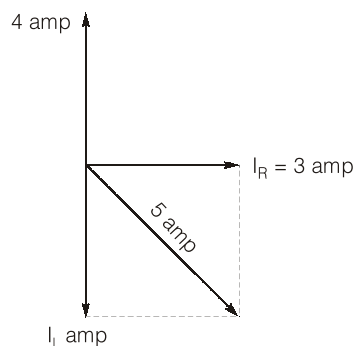
$$I = i - 1 = 2 - 1 = 1 \text{ Amp}$$

i.e. the current delivered by voltage source = 1 amp.

$$\therefore \text{ power delivered by voltage source} = 2 \times 1 = 2 \text{ W}$$

4. (d)

$$I_R = \sqrt{5^2 - 4^2} = 3 \text{ Amp}$$

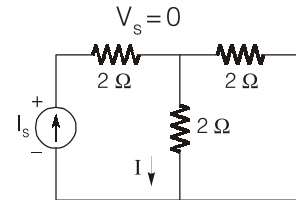


$$(I_L - 4)^2 + 3^2 = 5^2$$

$$I_L = 8 \text{ amp}$$

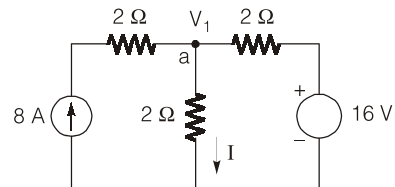
5. (b)

When



$$I = \frac{I_s}{2}$$

$$\Rightarrow I_s = 2I = 2 \times 4 = 8 \text{ A}$$



When

$$V_s = 16 \text{ V}$$

Applying KCL node a

$$-8 + \frac{V_1}{2} + \frac{V_1 - 16}{2} = 0$$

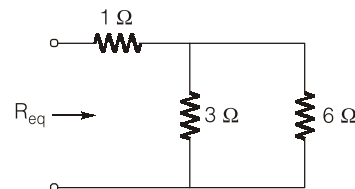
$$V_1 = 16 \text{ V}$$

$$I = \frac{V_1}{2} = \frac{16}{2} = 8 \text{ A}$$

6. (d)

Ideal voltage source keeps the terminal voltage constant so accordingly current will change and the voltage across each resistor is unchanged following superposition principle.

7. (d)



$$R_{eq} = 1 + (3 \parallel 6) = 3 \Omega$$

Voltage across current source

$$I_s R_{eq} = 2 \times 3 = 6 \text{ V}$$

8. (d)

$$I_R = \frac{24}{6} = 4 \text{ A}$$

Current delivered by the voltage source.

$$I = I_R + 2I_R = 3I_R = 3 \times 4 = 12 \text{ A}$$

Power delivered by the voltage source

$$= 24 \times 12 = 288 \text{ W}$$

9. (a)

Fewer nodes will give lesser nodal equation than mesh equations hence better analyzed by node analysis. So point 3 is not correct.

10. (c)

Angle between voltage across R & inductor will be  $30^\circ$  as given

$$\text{So, } \tan 30^\circ = \frac{X_L}{R}; R = \frac{X_L}{\tan 30^\circ} = \sqrt{3} \cdot X_L$$

$$\text{as } X_L = 1 \Omega$$

$$R = \sqrt{3} \Omega$$

11. (b)

Applying KCL

$$-1 + \frac{8-2}{2} - I = 0$$

$$\Rightarrow I = 2 \text{ A}$$

12. (c)

Assuming voltage of the node V

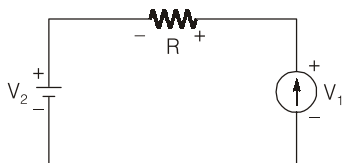
Applying KCL

$$\frac{V-140}{2} - 70 + \frac{V}{4} + \frac{V-70}{1} = 0$$

$$\Rightarrow V = 120 \text{ V}$$

$$I = \frac{V}{4} = \frac{120}{4} = 30 \text{ A}$$

13. (b)



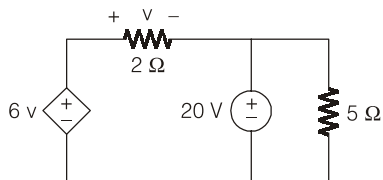
Assuming voltage across current source is  $V_1$

Applying KVL

$$V + IR - V_1 = 0$$

$$\Rightarrow V_1 = V + IR$$

14. (d)

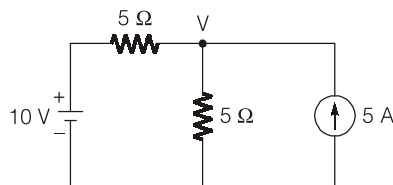


$$6v - v - 20 = 0$$

$$v = 4 \text{ V}$$

$$\text{Current through } 2\Omega \text{ resistor} = \frac{v}{2} = \frac{4}{2} = 2 \text{ A}$$

15. (d)



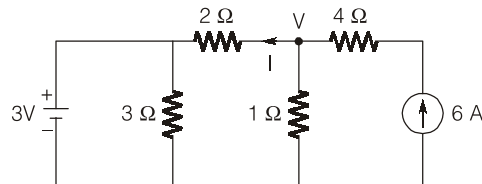
Applying Nodal Analysis

$$\frac{10-V}{5} + 5 = \frac{V}{5}$$

$$\therefore 10 - V + 25 = V$$

$$\therefore V = 17.5 \text{ V}$$

16. (d)



Applying Nodal Analysis

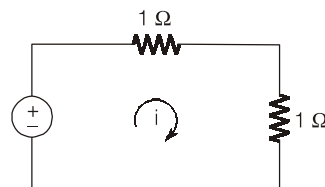
$$6 = \frac{V-3}{2} + \frac{V}{1}$$

$$12 = V - 3 + 2V$$

$$\therefore \boxed{V = 5 \text{ V}}$$

$$I = \frac{5-3}{2} = 1 \text{ A}$$

17. (b)



$$i = \frac{E}{2}$$

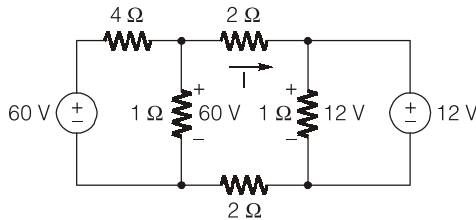
Power dissipated

$$P = \left(\frac{E}{2}\right)^2 \times 2 = 8$$

$$E^2 = 16$$

$$E = 4 \text{ V}$$

18. (d)



$$\begin{aligned} -60 + 2I + 12 + 2I &= 0 \\ 48 &= 4I \\ I &= 12 \text{ A} \end{aligned}$$

19. (d)

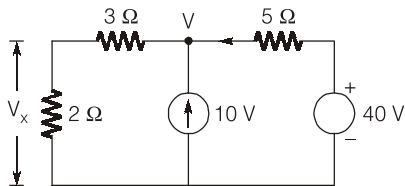
Applying KCL,

$$\frac{V-30}{10} - 9 + \frac{V-36}{20} = 0$$

$$V = 92 \text{ V}$$

Hence, option (d) is correct.

20. (c)



Applying KCL,

$$\frac{V}{5} + \frac{V-40}{5} - 10 = 0$$

$$V = 45 \text{ V}$$

$$V_x = \frac{V}{5} \times 2 = \frac{45}{5} \times 2 = 18 \text{ V}$$

Hence, option (c) is correct.

21. (b)

In any linear, planer network number of independent KVL equations are equal to number of links and KCL equations are  $(n - 1)$ .

22. (d)

Let current flowing through the circuit =  $I$ 

So that,  $V_A = 7I$ 
 $\therefore$  Using KVL,

$$36 - 15I - 2V_A - V_A = 0$$

$$36 - 15I - 3 \times (7I) = 0$$

$$\Rightarrow I = 1 \text{ A}$$

$$\text{and } V_A = 7 \text{ V}$$

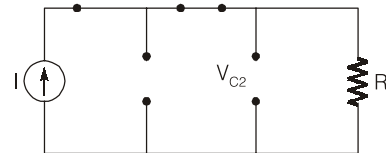
$$\begin{aligned} \therefore \text{Power dissipated in the controlled source} \\ = 2V_A I = 14 \text{ W} \end{aligned}$$

23. (d)

For any value of  $C$ ,  $I_1$  will always lead, the  $V_s$  by  $90^\circ$  and  $I_2$  will always lag, the  $V_s$  by  $45^\circ$   
 $\Rightarrow I_1$  leads  $I_2$  by  $90^\circ + 45^\circ = 135^\circ$ .

24. (d)

At steady state, inductor behaves like short circuit and capacitor behaves like open circuit.



So, from circuit

Current through  $L = I$ 

Voltage across  $C_2$ 

$$V_{c2} = I \times R$$

25. (b)

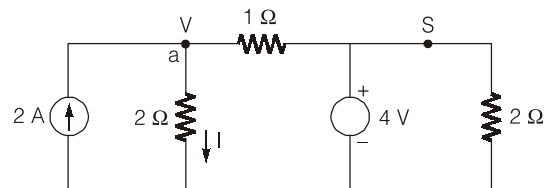
$$\begin{aligned} \text{Step response} &= \frac{d}{dt} (\text{Ramp response}) \\ &= \frac{d}{dt} (t + e^{-t}) \end{aligned}$$

$$\boxed{\text{Step response} = 1 - e^{-t}}$$

26. (b)

With  $S$  open, capacitor get charged to

$$V_c(0^-) = 2 \times 2 = 4 \text{ V}$$

The circuit at  $t = 0^+$ 


Applying KCL at node a

$$-2 + \frac{V}{2} + \frac{V-4}{1} = 0$$

$$\Rightarrow V = 4 \text{ Volt}$$

$$I = \frac{4}{2} = 2 \text{ Amp}$$

**Note:** Charged capacitor would not let the current flow through the  $1 \Omega$  resistor as potential difference across it would be zero.

27. (c)

$$q = C \cdot V$$

$$\therefore \frac{dq}{dt} = i = C \cdot \frac{dv}{dt} \quad \left( \frac{dv}{dt} \text{ would be negative as} \right.$$

current would decrease)

$$\text{also } v = iR = C \cdot \frac{dv}{dt} \cdot R$$

$$\therefore -50 = 20 \times 10^{-6} \times (-500) \times R$$

$$\Rightarrow R = 5 \text{ k}\Omega$$

28. (b)

$$v = 10 = i + \frac{1}{1} \int i \cdot dt$$

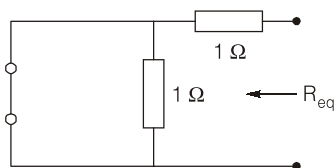
$$\text{taking Laplace transform. } \frac{10}{s} = I(s) + \frac{I(s)}{s}$$

$$\therefore I(s) = \frac{10}{(s+1)} \Rightarrow i(t) = 10e^{-t} \Rightarrow \tau = 1 \text{ s.}$$

OR

Time constant  $\tau = R_{eq} C_{eq}$

To find time constant open all the current source and close all the voltage source in the given network



$$\therefore R_{eq} = 1 \Omega$$

$$\text{and } C_{eq} = 1 \text{ F}$$

$$\therefore \tau = 1 \times 1 = 1 \text{ sec}$$

29. (a)

$$E_2 = iR + L \frac{di}{dt}$$

$$\text{at } t = 0, E_2 = -8R + 2 \times 3 \quad \dots(i)$$

$$\text{at } t = \infty, E_2 = 4 \times R \quad \dots(ii)$$

$$\text{from (i) and (ii) } R = 0.5 \Omega$$

30. (a)

At  $t = 3 \text{ s}$ , since  $2 \Omega$  is shorted,  $I_C$  jumps to a new value and then decreases with reduced time constant.

31. (c)

At steady state, capacitor acts as OC and at initial state it acts as SC. to dc current.

32. (b)

at  $t = 0$

Inductor acts as open circuit, so  $i_1 = 0$

Capacitor acts as short circuit, so  $i_2 = I$

33. (b)

$v(0^+) = 50 \text{ V}$  equal to battery emf at steady state

when switch S is at b.

When switch S is at a. The voltage across capacitor does not change instantaneously.

$$\therefore i(0^+) = \frac{50}{500} = 0.1 \text{ A} = 100 \text{ mA}$$

34. (b)

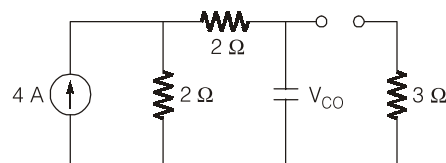
$$V(\infty) = 1 \text{ V}$$

$$\text{and } V(0^+) = 3 \text{ V}$$

$$\begin{aligned} v(t) &= V(\infty) + [V(0^+) - V(\infty)]e^{-t/\tau} \\ &= 1 + [3 - 1]e^{-3t} \\ &= 1 + 2e^{-3t} \end{aligned}$$

35. (d)

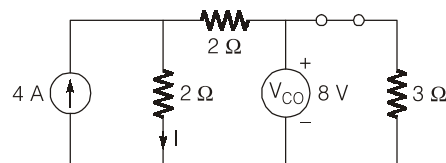
Equivalent circuit at  $t < 0$



$$\text{So, } V_{CO} = 4 \times 2 \text{ volt}$$

Capacitor will behave as open circuit at steady state.

Equivalent circuit at  $t > 0$ .

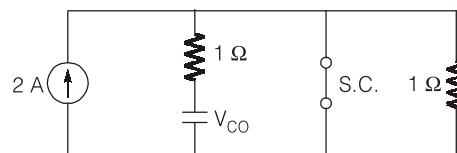


Using superposition

$$I = \frac{4 \times 2}{2 + 2} + \frac{8}{(2 + 2)} = 4 \text{ A}$$

36. (c)

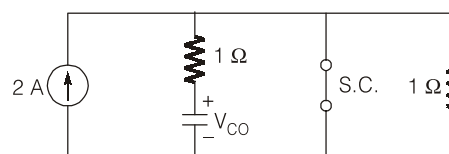
Equivalent circuit for  $t < 0$ .



As capacitor will be open in steady state

$$\Rightarrow V_{CO} = 2 \times 1 \text{ volt.}$$

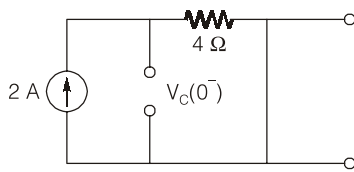
equivalent circuit  $t > 0$



At  $t = \infty$  capacitor will be again open. So,  $V_{C(\infty)} = 0$  as capacitor is across a short circuit.

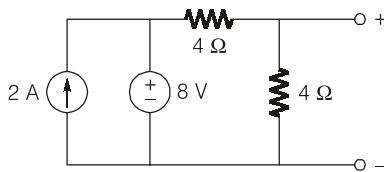
37. (b)

At  $t = 0^-$



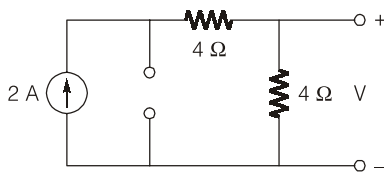
$$V_C(0^-) = 8 \text{ V}$$

at  $t = 0^+$



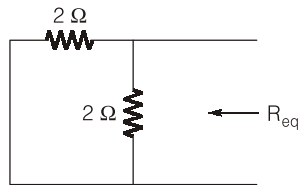
$$V(0^+) = \frac{8 \times 4}{8} = 4 \text{ V}$$

at  $t = \infty$



$$V(\infty) = 8 \text{ V}$$

38. (b)



$$R_{eq} = (2 \parallel 2) = 1 \Omega$$

$$\text{Time constant} = R_{eq} \times C = 1 \times 1 = 1 \text{ s}$$

39. (a)

Applying nodal analysis

$$\frac{3 - V}{4} = \frac{V}{1} + \frac{CdV}{dt}$$

$$\frac{3 - 1}{4} = 1 + C(-10)$$

$$\frac{1}{2} - 1 = -10C$$

$$C = \frac{1}{20} = 0.05 \text{ F}$$

40. (c)

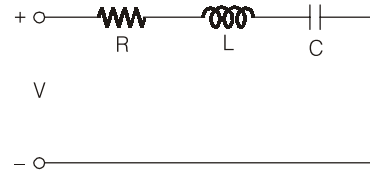
To have zero transient instantaneous angle of source should be equal to impedance angle.

41. (c)

at  $t = 0$  inductor will behave as open and

at  $t = \infty$  Capacitor will behave as open

So,  $I_0 = 0$  and  $I_\infty = 0$



42. (c)

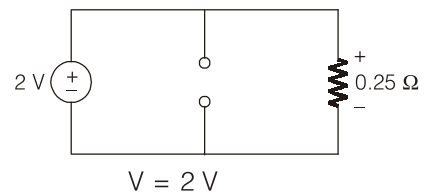
When system is initially at rest: Inductor will behave as open circuit and capacitor act as short circuit

$$\therefore I = \frac{50}{5} = 10 \text{ A}$$

43. (a)

at

$t = 0^+$



$$V = 2 \text{ V}$$

44. (a)

$$V_L = L \frac{di}{dt}$$

Under steady-state condition current through inductor does not change with time.

$$\therefore V_L = 0$$

and inductor acts as short circuit.

45. (d)

Both theorems are dual i.e., they follow duality principle.

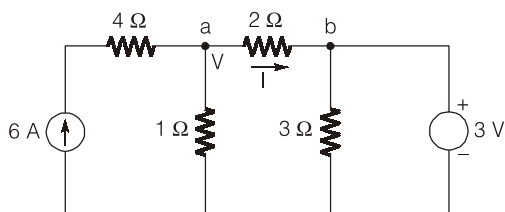
46. (c)

According to reciprocity theorem, the ratio of excitation to response is constant when the position of excitation and response are interchanged.

$$\frac{E_{AB}}{I_{CD}} = \frac{E_{CD}}{I_{AB}}$$

$$\Rightarrow I_{AB} = \frac{E_{CD} \times I_{CD}}{E_{AB}} = \frac{100 \times 1}{10} = 10 \text{ A}$$

47. (c)



Applying KCL at node a

$$-6 + \frac{V}{1} + \frac{V-3}{2} = 0$$

$$-12 + 2V + V - 3 = 0$$

$$3V = 15$$

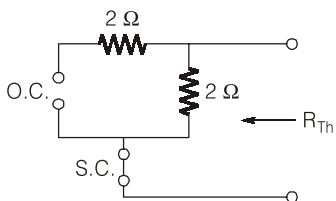
$$\Rightarrow V = 5 \text{ Volts}$$

$$I = \frac{V-3}{2}$$

$$= \frac{5-3}{2} = 1 \text{ A}$$

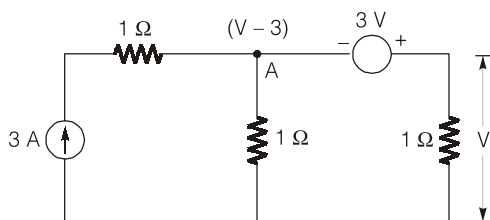
48. (b)

For finding  $R_{th}$ , voltage source is short circuited and current source is open circuited.



$$\therefore R_{th} = 2 \Omega$$

49. (c)

Voltage of node A =  $V - 3$ 

Applying KCL at node A

$$-3 + \frac{V-3}{1} + \frac{V}{1} = 0$$

$$V = 3 \text{ Volt}$$

50. (d)

v-i characteristic is  $i = \frac{1}{5}v - 4$

$$\therefore R_{AB} = \frac{dv}{di} = 5 \Omega$$

51. (b)

For maximum power transfer, load impedance is complex conjugate of source impedance.

52. (c)

Superposition theorem is not applicable for nonlinear parameters.

$$\therefore P = I^2 R \text{ or } \frac{V^2}{R}$$

$\therefore$  not applicable for power calculation.

53. (c)

$$I = \frac{V_{Th}}{R_{Th}} = 3 \text{ for } R = 0 \quad \dots(i)$$

$$I = \frac{V_{Th}}{R_{Th} + 2} = \frac{3}{2} \text{ for } R = 2 \quad \dots(ii)$$

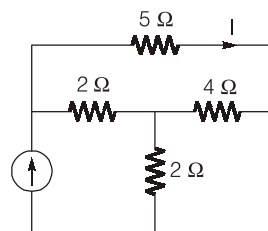
From (i) & (ii)  $V_{Th} = 6V$ ,  $R_{Th} = 2 \Omega$

$$\therefore I \text{ for } (R = 1) = \frac{6}{2+1} = 2A$$

54. (a)

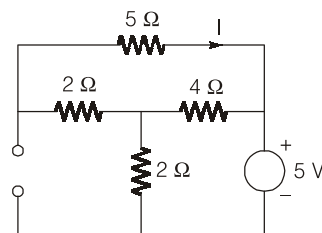
Applying superposition theorem

Current due to current source



$$I = \frac{1}{5 + (2 + 4 \parallel 2)} \times (2 + 4 \parallel 2) = 0.4 \text{ A}$$

Current due to voltage source

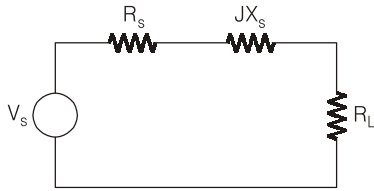


$$\begin{aligned} -I &= \frac{5}{2 + \{(5+2) \parallel 4\}} \times \left\{ \frac{4}{4 + (5+2)} \right\} \\ &= -0.4 \text{ A} \end{aligned}$$

Current due to both sources

$$= 0.4 + (-0.4) = 0$$

55. (c)

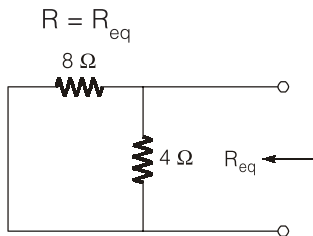


For maximum power transfer,

$$R_L = \sqrt{R_s^2 + X_s^2} = \sqrt{8^2 + 6^2} = 10 \Omega$$

56. (a)

For maximum power transfer from source



$$R_{eq} = 8 \parallel 4 = \frac{32}{12} = \frac{8}{3} \Omega$$

$$R = R_{eq} = \frac{8}{3} \Omega$$

57. (c)

Norton's equivalent is dual of Thevenin's equivalent not reciprocal.

58. (b)

Superposition theorem is valid for linear network. Tellegen's theorem is valid irrespective of type of network, types of elements contained in the network, value of each element contained in the network, type of voltage and current sources present in the network (dependent/independent).

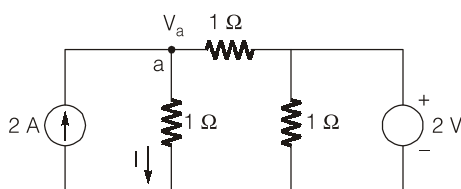
59. (d)

When  $I_s = 0$

$$I = 1 = \frac{V}{2}$$

$\Rightarrow V = 2 \text{ V}$

When  $I_s = 2 \text{ A}$



By applying KCL at node a

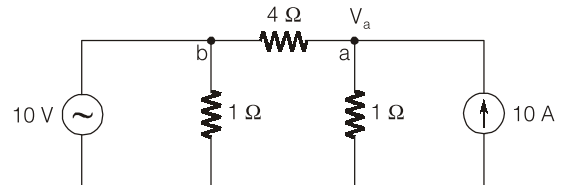
$$-2 + \frac{V_a}{1} + \frac{V_a - 2}{1} = 0$$

$$\Rightarrow -2 + 2V_a - 2 = 0$$

$$V_a = 2 \text{ V}$$

$$I = \frac{V_a}{1} = \frac{2}{1} = 2 \text{ A}$$

60. (a)



By applying KCL at node a

$$-10 + \frac{V_a}{1} + \frac{V_a - 10}{4} = 0$$

$$\Rightarrow V_a = 10 \text{ V}$$

$$I = \frac{10 - V_a}{4} = \frac{10 - 10}{4} = 0 \text{ A}$$

61. (b)

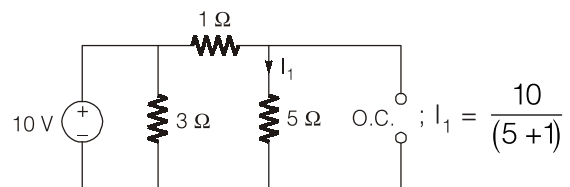
$$2 = \left( \frac{I_N}{R_N + R} \right) \times R_N$$

$$\Rightarrow 2 = \frac{4}{2 + R} \times 2$$

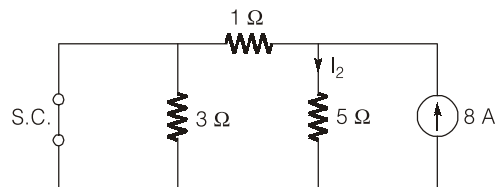
$$\Rightarrow R = 2 \Omega$$

62. (d)

Circuit for current due to voltage source only.



Circuit for current due to current source only



$$I_2 = \frac{1}{5 + 1} \times 8 \quad (\text{current division rule})$$

$$\text{So total current } I_1 + I_2 = \frac{10}{6} + \frac{8}{6} = 3 \text{ Amp.}$$