CLASS TEST

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ELECTRICAL ENGINEERING

Network Theory

Duration : 1:00 hr. **Maximum Marks : 50**

Read the following instructions carefully

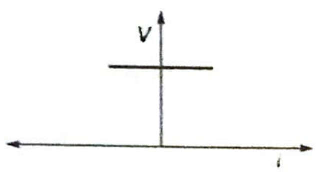
1. This question paper contains **30** objective questions. **Q.1-10** carry one mark each and **Q.11-30** carry two marks each.
2. Answer all the questions.
3. Questions must be answered on Objective Response Sheet (**ORS**) by darkening the appropriate bubble (marked **A**, **B**, **C**, **D**) using HB pencil against the question number. Each question has only one correct answer. In case you wish to change an answer, erase the old answer completely using a good soft eraser.
4. There will be **NEGATIVE** marking. For each wrong answer **1/3rd** of the full marks of the question will be deducted. More than one answer marked against a question will be deemed as an incorrect response and will be negatively marked.
5. Write your name & Roll No. at the specified locations on the right half of the **ORS**.
6. No charts or tables will be provided in the examination hall.
7. Choose the **Closest** numerical answer among the choices given.
8. If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that questions.
9. If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

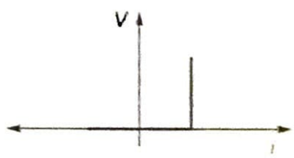
Q.No. 1 to Q.No. 10 carry 1 mark each

Q.1 The V-I characteristics of an ideal current source is

(a)

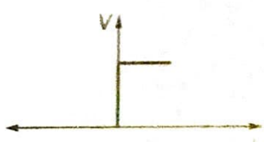


(b)

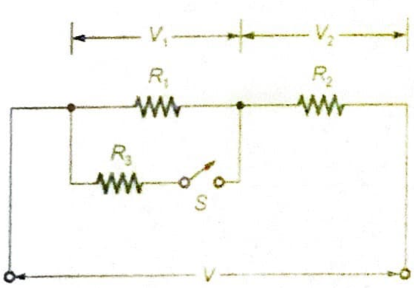


(c)

(d)

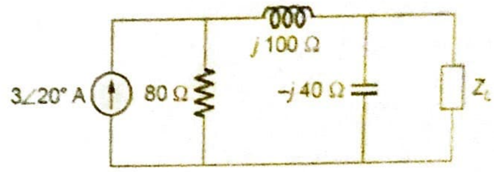


Q.2 In the circuit shown below, how will the voltage V_1 and V_2 change when the switch S is closed?



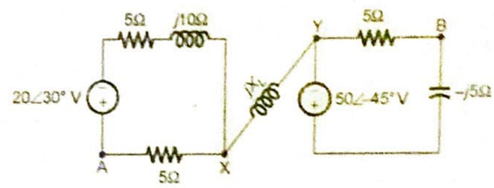
(a) V_1 decreases, V_2 increases
(b) V_1 increases, V_2 decreases
(c) V_1 and V_2 decrease
(d) V_1 and V_2 increase

Q.3 The value of load impedance that will absorb the maximum average power for the circuit shown below is



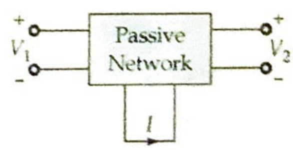
(a) 12.8 − j 49.6 Ω (b) 12.8 + j 49.6 Ω
(c) 33.9 − j 86.3 Ω (d) 33.9 + j 86.3 Ω

Q.4 The voltage V_{AB} in the circuit shown below is:



(a) 28.6 ∠183.7° V (b) 32.3 ∠150° V
(c) 22.3 ∠140° V (d) 20.7 ∠113.6° V

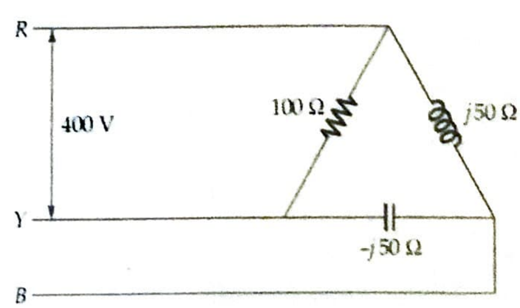
Q.5 In the network shown below, the measurements obtained are given in the table. If V_1 = 10 V and V_2 = 5 V then the current I is



V_1	V_2	I
4 V	0 V	1 A
0 V	5 V	-1 A

(a) 2.5 A (b) 1.5 A
(c) 1 A (d) 0.5 A

Q.6 The set of 3 equal resistors, each of value R Ω, connected in Y-across R-Y-B of figure, consume the same power as the unbalanced Δ connected load, shown in the figure the value of R is



(a) 80 Ω (b) 100 Ω
(c) 120 Ω (d) 140 Ω

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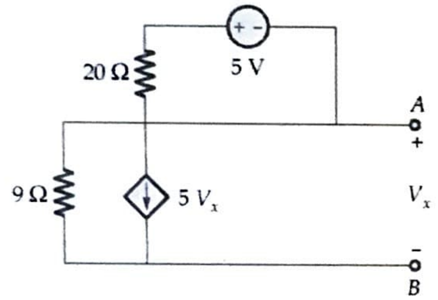
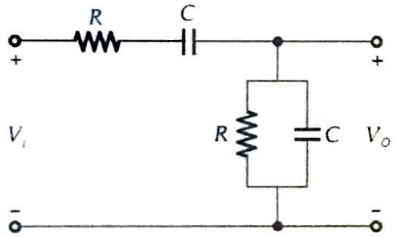
Q.7 The Thevenin's equivalent resistance seen across the terminal A and B of the circuit shown in the figure below is



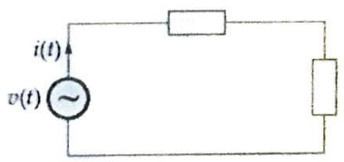
(a) 20 Ω (b) 9 Ω
(c) 6.206 Ω (d) 195.65 mΩ

Q.8 The RC circuit shown in the figure is



(a) a low-pass filter
(b) a high-pass filter
(c) a band-pass filter
(d) a band-reject filter

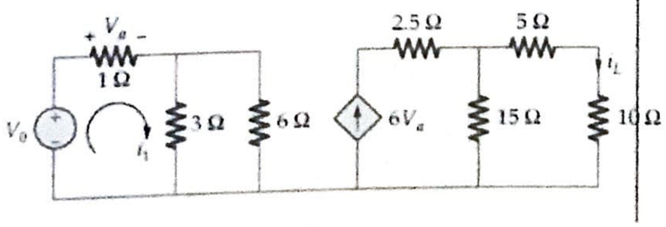
Q.9 The two elements in the circuit given below are,



Where, $v(t) = 50\cos(5000t + 30°)$ V
$i(t) = 10\cos(5000t - 23.13°)$ A

(a) $R = 4\ \Omega$ and $C = 0.4$ mF
(b) $R = 4.5\ \Omega$ and $L = 0.6$ mH
(c) $R = 3\ \Omega$ and $L = 0.8$ mH
(d) $R = 3\ \Omega$ and $C = 0.8$ mF

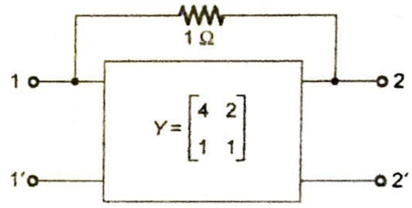
Q.10 What is the magnitude of V_0, when power loss in 10 Ω resistor is 90 Watt?



(a) 15 V (b) 9 V
(c) 6 V (d) 3 V

Q.No. 11 to Q.No. 30 carry 2 marks each

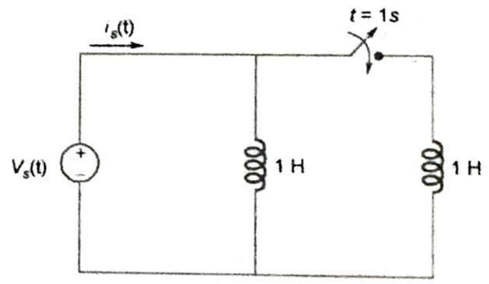
Q.11 The Y parameters of a four-terminal block are $\begin{bmatrix} 4 & 2 \\ 1 & 1 \end{bmatrix}$. A single resistor of 1 ohm is connected across as shown in the figure. The new Y parameters will be



(a) $\begin{bmatrix} 5 & 1 \\ 0 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & 3 \\ 2 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & 2 \\ 1 & 1 \end{bmatrix}$

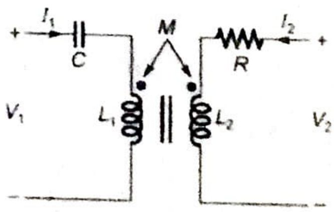
Q.12 In the circuit shown below.



The source voltage $V_s(t) = \cos(t)$ V for $t \geq 0$ and 0 otherwise. The input current $i_s(t)$ for $t \geq 0$ is

(a) $1 + \sin(2t)$ A (b) $2\sin(1) - \sin(t)$ A
(c) $1 + 2\sin(t - 1)$ A (d) $2\sin(t) - \sin(1)$ A

Q.13 The Z matrix for the following circuit is



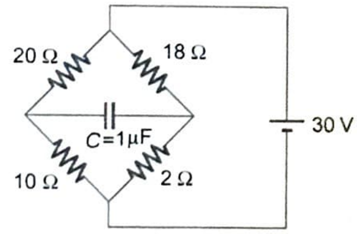
(a) $\begin{bmatrix} \frac{1}{sC} + sL_1 + sM & 1 \\ 1 & R + sL_2 + sM \end{bmatrix}$

(b) $\begin{bmatrix} sL_1 + \frac{1}{sC} & 1 \\ 1 & sL_2 + R \end{bmatrix}$

(c) $\begin{bmatrix} \frac{1}{sC} + sL_1 & sM \\ sM & R + sL_2 \end{bmatrix}$

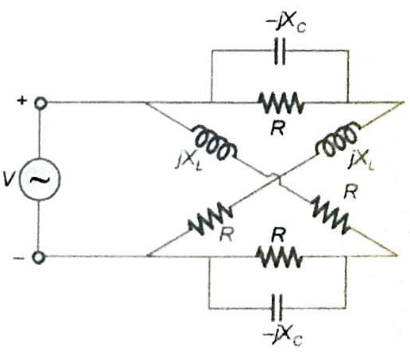
(d) does not exist

Q.14 In the given figure shown below, stored energy of the capacitor is



(a) 24.5 μJ
(b) 26.5 μJ
(c) 28.5 μJ
(d) 30.5 μJ

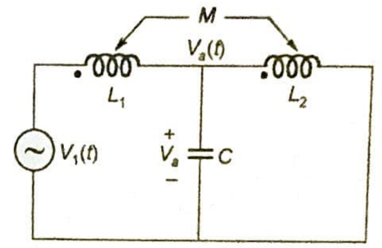
Q.15 The condition on R, X_L and X_C such that current is in phase with applied voltage will be



(a) $X_L = \frac{R^2 X_C}{R^2 + X_L^2}$
(b) $X_C = \frac{R^2 X_L}{R^2 + X_C^2}$

(c) $X_C = \frac{R^2 X_L}{R^2 + X_L^2}$
(d) $X_L = \frac{R^2 X_C}{R^2 + X_C^2}$

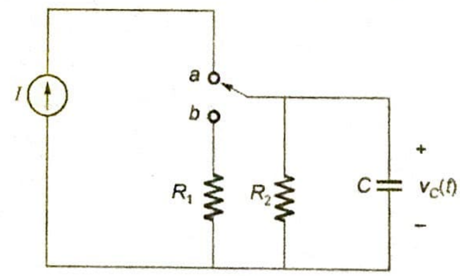
Q.16 In the circuit shown below, $L_1 = L_2 = 1$ H, $M = \frac{1}{4}$ H, C = 1 F and $V_1(t) = 2\cos t$ V.



The voltage $V_a(t)$ is

(a) $2\cos t$ V
(b) $1.6\cos t$ V
(c) $1.6\sin t$ V
(d) $-1.6\cos t$ V

Q.17 In the figure shown below switch is kept at position 'a' before moving to position 'b' at $t = 0$. When switch is moved to position 'b' voltage across capacitor $v_C(t)$ is given by



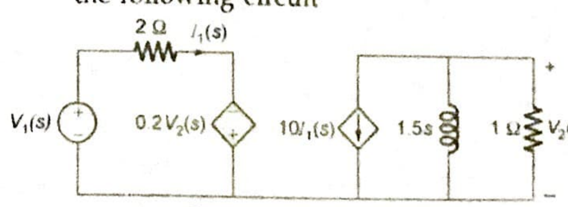
(a) $I\frac{R_1 R_2}{R_1 + R_2} e^{-\frac{t}{R_2 C}}$

(b) $IR_2 e^{-\frac{(R_1 + R_2)t}{R_1 R_2 C}}$

(c) $I(R_1 + R_2)e^{-\frac{t}{R_2 t}}$

(d) $I\frac{(R_1 \times R_2)}{R_1 + R_2} e^{-\left(\frac{R_1 + R_2}{R_1 R_2 C}\right)t}$

Q.18 What is the input admittance function for the following circuit



(a) $\frac{6s + 2}{1.5s + 1}$
(b) $\frac{1.5s + 1}{6s + 2}$

(c) $\frac{0.5s + 1}{1.5s + 2}$
(d) $\frac{1.5s + 2}{0.5s + 1}$

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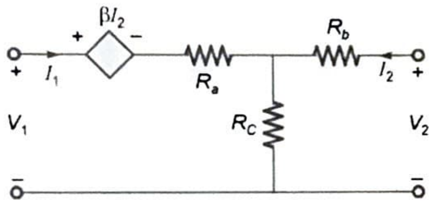
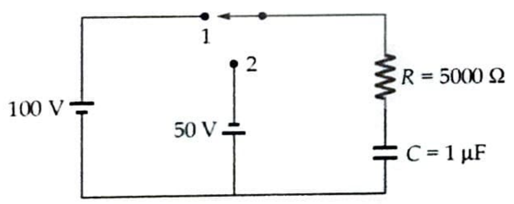
Q.19 For the two port network given below, the value of Z_{12} is



(a) $R_a + R_c$
(b) $\beta + R_a + R_c$
(c) $\beta + R_c$
(d) $\beta + R_b$

Q.20 The switch in the circuit shown below is moved from 1 to 2 at $t = 0$. V_C and V_R at $t > 0$ respectively are

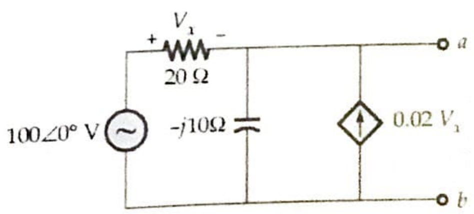


(a) $(50\,e^{-200t} + 100)$V and $(150\,e^{-200t})$ V
(b) $(150\,e^{-200t} - 50)$V and $(150\,e^{-200t})$ V
(c) $(50\,e^{-200t} + 50)$V and $(100\,e^{-200t})$ V
(d) $(100\,e^{-200t} + 50)$V and $(100\,e^{-200t})$ V

Q.21 A 4 A, current source, a 20 Ω resistor and a 5 μF capacitor are all in parallel. The amplitude of current source drops suddenly to zero at $t = 0$. The time taken by the capacitor voltage to drop one half of its initial value is

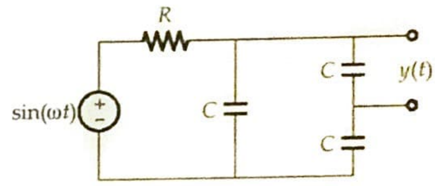
(a) 64.1 ms
(b) 64.1 μs
(c) 69.3 ms
(d) 69.3 μs

Q.22 The Thevenin's equivalent of the network shown below is,



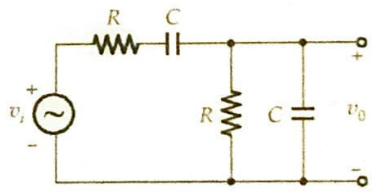
(a) $57.34\angle{-55^\circ}$ V and $(4.7 - j6.7)$ Ω
(b) $57.34\angle{-61^\circ}$ V and $(4.7 - j2.4)$ Ω
(c) $55\angle{57.3^\circ}$ V and $(6.7 - j4.7)$ Ω
(d) $55\angle{-24^\circ}$ V and $(4.2 - j6.7)$ Ω

Q.23 The steady state output of the circuit shown in the figure is given by $y(t) = A(\omega)\sin(\omega t + \phi(\omega))$. If the amplitude $|A(\omega)| = 0.25$, then the frequency ω is



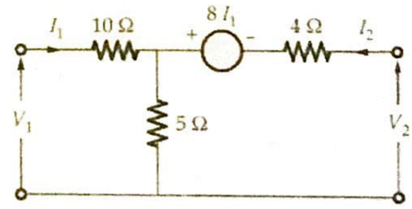
(a) $\dfrac{1}{\sqrt{3}\,RC}$
(b) $\dfrac{2}{\sqrt{3}\,RC}$
(c) $\dfrac{1}{RC}$
(d) $\dfrac{2}{RC}$

Q.24 The circuit shown below is driven by a sinusoidal input $v_i = V_p \cos(t/RC)$. The steady output v_0 is



(a) $(V_p/3)\cos(t/RC)$
(b) $(V_p/3)\sin(t/RC)$
(c) $(V_p/2)\cos(t/RC)$
(d) $(V_p/2)\sin(t/RC)$

Q.25 For the network shown in the figure, Y_{11} and Y_{12} are, respectively



(a) $\dfrac{3}{50}$ mho and $-\dfrac{1}{30}$ mho
(b) $\dfrac{3}{50}$ mho and $\dfrac{1}{30}$ mho
(c) $-\dfrac{3}{50}$ mho and $-\dfrac{1}{30}$ mho
(d) $-\dfrac{3}{50}$ mho and $\dfrac{1}{30}$ mho

Q.26 In a series RLC circuit, L = 40 mH is given. If the instantaneous voltage and current 100cos(314t – 5°) V and 10cos(314t – 50°) A, respectively, the value of R and C will be

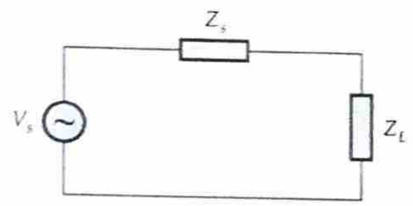
(a) R = 10 Ω and C = 580 μF

(b) R = 7.07 Ω and C = 580 μF

(c) R = 7.07 Ω and C = 5.49 mF

(d) R = 14.14 Ω and C = 5.49 mF

Q.27 Consider the circuit shown in the figure below,



Assume V_s = 250sin500t V and Z_s = (100 + j200) Ω. If Z_L to be a parallel combination of R and C, then the value of R and C such that the maximum power transfer takes from source to load are respectively.

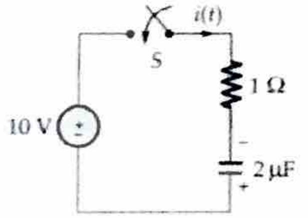
(a) R = 8 Ω and C = 500 μF

(b) R = 100 Ω and C = 10 μF

(c) R = 250 Ω and C = 250 μF

(d) R = 500 Ω and C = 8 μF

Q.28 For the circuit shown in the figure below, assume that initial charge on capacitor as 250 μC. The current $i(t)$ following switching at t = 0 will be



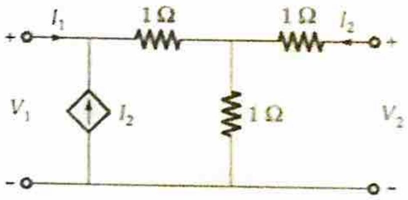
(a) $(125e^{-2\times10^5 t})$ A

(b) $(135e^{-5\times10^5 t})$ A

(c) $(10e^{-2\times10^5 t})$ A

(d) $(12.5e^{-5\times10^5 t})$ A

Q.29 For the circuit shown in the figure below, The equivalent z-parameter matrix is



(a) $\begin{bmatrix} 2\,\Omega & 3\,\Omega \\ 1\,\Omega & 1\,\Omega \end{bmatrix}$

(b) $\begin{bmatrix} 2\,\Omega & 1\,\Omega \\ 1\,\Omega & 1\,\Omega \end{bmatrix}$

(c) $\begin{bmatrix} 2\,\Omega & 3\,\Omega \\ 1\,\Omega & 3\,\Omega \end{bmatrix}$

(d) $\begin{bmatrix} 2\,\Omega & 3\,\Omega \\ 1\,\Omega & 2\,\Omega \end{bmatrix}$

Q.30 For a series RLC resonant circuit, the resonant frequency is given as 8 MHz and the bandwidth is 7.2 kHz. If the value of effective resistance is 4.5 Ω, then the capacitance C will be equal to

(a) 0.49 pF

(b) 3.98 pF

(c) 12.45 pF

(d) 31.84 pF

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