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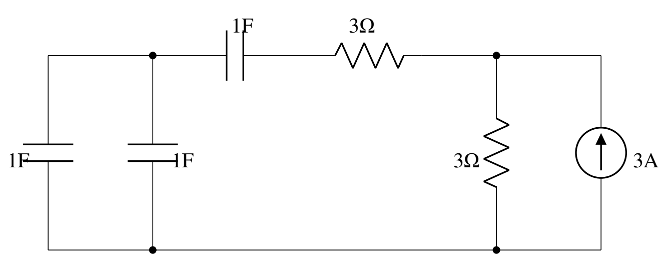
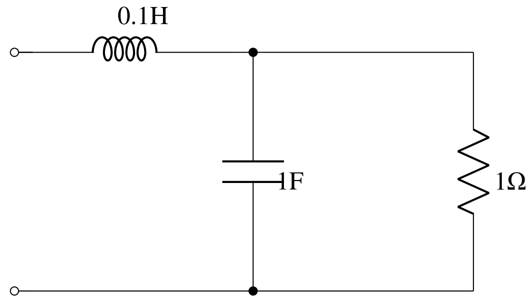
1) A 3-phase Voltage source Inverter is operated in 180° conduction mode.Which one of the following statements is true?
   a) Both pole-voltage and line-voltage will have 3^{rd} harmonic components
   b) Pole-voltage will have 3^{rd} harmonic components but line-voltage will be free from 3^{rd} harmonic
   c) Line-voltage will have 3^{rd} harmonic components but pole-voltage will be free from 3^{rd} harmonic
   d) Both pole-voltage and line-voltage will be free from 3^{rd} harmonic components
2) The impulse response of a causal linear time-invariant system is given as $h(t)$. Now consider the following two statements:
   Statement (I): Principle of superposition holds
   Statement (II): $h(t) = 0$ for $t < 0$
   Which one of the following statements is correct?
   (A) Statement (I) is correct and Statement (II) is wrong
   (B) Statement (II) is correct and Statement (I) is wrong
   (C) Both Statement (I) and Statement (II) are wrong
   (D) Both Statement (I) and Statement (II) are correct
3) It is desired to measure parameters of 230v/115v,2kVA, single-phase transformer. The following wattmeters are available in a laboratory.
   W_1 : 250V, 10A, Low Power Factor
   W_2 : 250v,5A,Low Power Factor
   W_3 : 150V, 10A, High Power Factor
   W_4 : 150V, 5A, High Power Factor
   The wattmeters used in open circuit test and short circuit test of the transformer will respectively be
   a) W_1 and W_2
   b) W_2 and W_4
   c) W_1 and W_4
   d) W_2 and W_3
4) The time constant for the given circuit will be

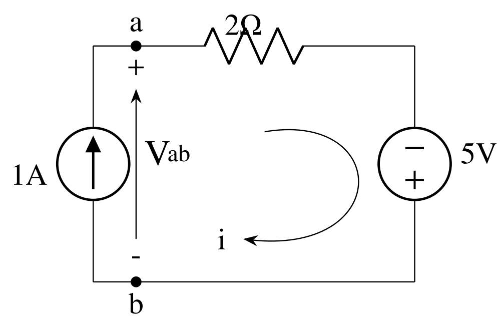


   a) $\frac{1}{9}$s
   b) $\frac{1}{4}$s
   c) 4s
   d) 9s
5) The resonant frequency for the given circuit will be
   a) 1 $\frac{rad}{s}$



b) 2 $\frac{rad}{s}$
c) 3 $\frac{rad}{s}$
d) 4 $\frac{rad}{s}$

6) Assuming ideal elements in a circuit shown below, the voltage V_{ab} will be

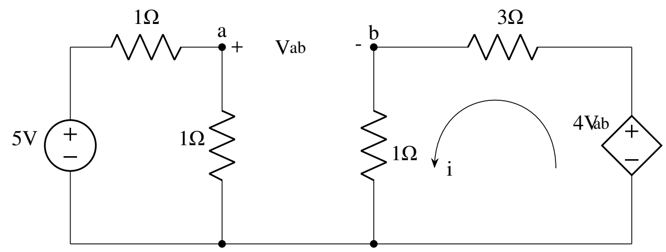


a) -3V
b) 0V
c) 3V
d) 5V

7) A capacitor consists of 2 metal plates each $500 \times 500 mm^2$ and spaced 6 mm apart. The space between the metal plates is filled with glass plate of 4mm thickness and a layer of paper of 2mm thickness. The relative permittivities of the glass and paper are 8 and 2 respectively. Neglecting the fringing effect, the capacitance will be (Given that $\epsilon_0 = 8.85 \times 10^{-12} \frac{F}{m}$)
a) 983.33pF
b) 1475 pF
c) 6637.5 pF
d) 9956.25 pF

8) A coil of 300 turns is wound on a non -magnetic core having a mean circumference of 300mm and a cross-sectional area of $300 mm^2$. The inductance of the coil corresponding to a magnetizing current of 3A will be (Given that $\mu_0 = 4\pi \times 10^{-7}$)
a) $37.68 \mu H$
b) $113.04 \mu H$
c) 37.68 mH
d) 113.04 mH

9) In the circuit shown in the figure, the value of the current i will be given by
a) 0.31A
b) 1.25A
c) 1.75A
d) 2.5A



10) Two point charges $Q_1 = 10\mu C$ and $Q_2 = 20\mu C$ are placed at coordinates $(1, 1, 0)$ and $(-1, -1, 0)$ respectively. The total electric flux passing through a plane $z = 20$ will be
    a) $7.5\mu C$
    b) $135\mu C$
    c) $15.0\mu C$
    d) $22.5\mu C$
11) Given a sequence $x[n]$, to generate the sequence $y[n] = x[3 - 4n]$, which one of the folllowing procedures would be correct?
    a) First delay x[n] by 3 samples to generate $z_1[n]$, then pick every 4^{th} sample of $z_1[n]$ to generate $z_2[n]$, and then finally time reverse $z_2[n]$ to obtain y[n]
    b) First advance x[n] by 3 samples to generate $z_1[n]$, then pick every 4^{th} sample of $z_1[n]$ to generate $z_2[n]$, and then finally time reverse $z_2[n]$ to obtain y[n]
    c) First pick every fourth sample of x[n] to generate $V_1[n]$, time-reverse $v_1[n]$ to obtain $v_2[n]$, and finally advance $v_2[n]$ by 3 samples to obtain y[n]
    d) First pick every fourth sample of x[n] to generate $V_1[n]$, time-reverse $v_1[n]$ to obtain $v_2[n]$, and finally delay $v_2[n]$ by 3 samples to obtain y[n]
12) A system with input $x(t)$ and output $y(t)$ is defined by the input-output relation:

$$y(t) = \int_{-\infty}^{-2t} x(\tau)\, d\tau \tag{1}$$

    The system will be
    a) casual,time-invariant and unstable
    b) casual, time-invariant and stable
    c) non-casual,time-invariant and unstable
    d) non-casual, time-invariant and unstable
13) A signal $x(t) = \sin c(\alpha t)$ where α is a real constant $\left(\sin c(x) = \frac{\sin(\pi x)}{\pi x}\right)$ is the input to a Linear Time invariant system whose impulse response $h(t) = \sin c(\beta t)$ where β is a real constant. If $min(\alpha, \beta)$ denotes the minimum of α and β, and similarly $max(\alpha, \beta)$ denotes the maximum of α and β, and K is a constant, which one of the following statements is true about the **output of the system**?
    a) It will be of the form $K \sin c(\gamma t)$ where $\gamma = min(\alpha, \beta)$
    b) It will be of the form $K \sin c(\gamma t)$ where $\gamma = max(\alpha, \beta)$
    c) It will be of the form $K \sin c(\alpha t)$
    d) It cannot be a $\sin c$ type of signal
14) Let $x(t)$ be a periodic signal with time period T. let $y(t) = x(t - t_0) + x(t + t_0)$ for some t_0. The Fourier Series coefficients of $y(t)$ are denoted by b_k. If $b_k = 0$ for all odd k, then t_0 can be equal to
    a) $\frac{T}{8}$
    b) $\frac{T}{4}$
    c) $\frac{T}{2}$
    d) $2T$

15) $H(z)$ is a transfer function of a real system. When a signal $x[n] = (1 + j)^n$ is the input to such a system, the output is zero. Further, the Region of Convergence (ROC) of $\left(1 - \frac{1}{2}z^{-1}\right) H(z)$ is the entire Z-plane (except $z = 0$). It can then be inferred that $H(z)$ can have a minimum of
   a) one pole and one zero
   b) one pole and two zeros
   c) two poles and one zero
   d) two poles and two zeros
16) Given $X(z) = \frac{z}{(z-a)^2}$ with $|z| > a$, the residue of $X(z) z^{n-1}$ at $z = a$ for $n \geq 0$ will be
   a) a^{n-1}
   b) a^n
   c) na^n
   d) na^{n-1}
17) Consider function $f(x) = \left(x^2 - 4\right)^2$ where x is a real number. Then the function has
   a) only one minimum
   b) only two minima
   c) three minima
   d) three maxima