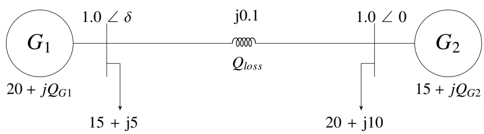
GATE 3

AI24BTECH11033 - Tanishq

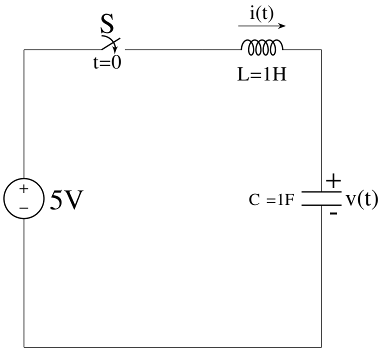
1) A $0-1$ Ampere moving iron ammeter has an internal resistance of $50m\Omega$ and inductance of $0.1mH$. A shunt coil is connected to extend its range to $0-10$ Ampere for all operating frequencies. The time constant in milliseconds and resistance in $m\Omega$ of the shunt coil respectively are
   a) 2, 5.55
   b) 2, 1
   c) 2.18, 0.55
   d) 11.1, 2
2) The positive, negative and zero sequence impedances of a three phase generator are Z_1, Z_2 and Z_0 respectively. For a line-to-line fault with fault impedance Z_f, the fault current is $I_f = kI_f$, where I_f is the fault current with zero fault impedance. The relation between Z_f and k is
   a) $Z_f = \frac{(Z_1+Z_2)(1-k)}{k}$
   b) $Z_f = \frac{(Z_1+Z_2)(1+k)}{k}$
   c) $Z_f = \frac{(Z_1+Z_2)k}{1-k}$
   d) $Z_f = \frac{(Z_1+Z_2)k}{1+k}$
3) Consider the two bus power system network with given loads as shown in the figure. All the values shown in the figure are in per unit. The reactive power supplied by generator G_1 and G_2 are Q_{G1} and Q_{G2} respectively. The per unit values of Q_{G1}, Q_{G2}, and line reactive power loss (Q_{loss}) respectively are

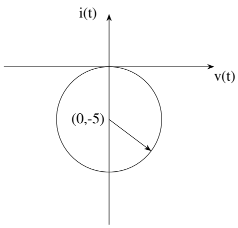


   a) 5.00, 12.68, 2.68
   b) 6.34, 10.00, 1.34
   c) 6.34, 11.34, 2.68
   d) 5.00, 11.34, 1.34
4) The per-unit power output of a salient-pole generator which is connected to an infinite bus, is given by the expression, $P = 1.4\sin\delta + 0.15\sin 2\delta$, where δ is the load angle. Newton-Raphson method is used to calculate the value of δ for $P = 0.8$ pu. If the initial guess is $30°$, then its value (in degree) at the end of the first iteration is
   a) $15°$
   b) $28.48°$
   c) $28.74°$

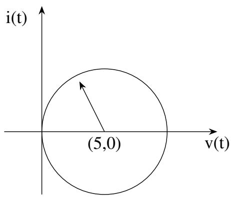
d) 31.20°

5) A DC voltage source is connected to a series L-C circuit by turning on the switch S at time $t = 0$ as shown in the figure. Assume $i(0) = 0, v(0) = 0$. Which one of the following circular loci represents the plot of $i(t)$ versus $v(t)$?

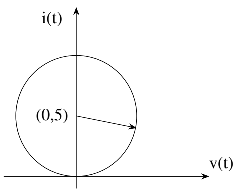




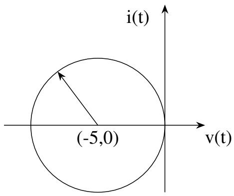
a)



b)

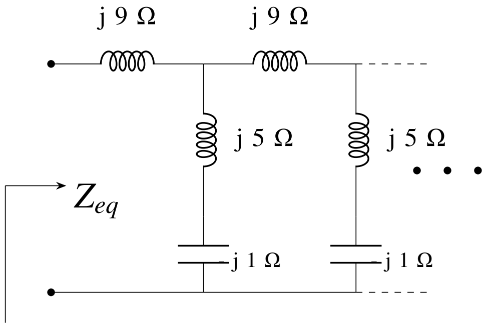


c)



d)

6) The equivalent impedance Z_{eq} for the infinite ladder circuit shown in the figure is



a) j12Ω
b) -j12Ω
c) j13Ω
d) 13Ω

7) Consider a system governed by the following equations:

$$\frac{dx_1(t)}{dt} = x_2(t) - x_1(t) \tag{7.1}$$
$$\frac{dx_2(t)}{dt} = x_1(t) - x_2(t) \tag{7.2}$$

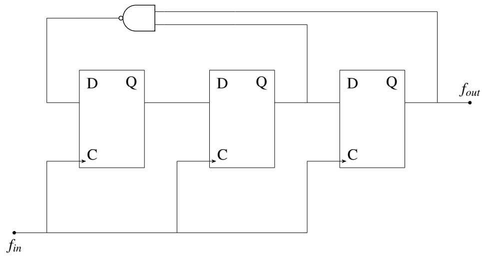
The initial conditions are such that $x_1(0) < x_2(0) < \infty$. Let $x_{1f} = \lim_{t\to\infty} x_1(t)$ and $x_{2f} = \lim_{t\to\infty} x_2(t)$. Which one of the following is true?

a) $x_{1f} < x_{2f} < \infty$
b) $x_{2f} < x_{1f} < \infty$
c) $x_{1f} = x_{2f} < \infty$
d) $x_{1f} = x_{2f} = \infty$

8) The number of roots of the polynomial, $s^7 + s^6 + 7s^5 + 14s^4 + 31s^3 + 73s^2 + 25s + 200$, in the open left half of the complex plane is

a) 3
b) 4
c) 5
d) 6

9) If C is a circle $|z| = 4$ and $f(z) = \frac{z^2}{(z^2-3z+2)^2}$, then $\oint_C f(z)dz$ is
   a) 1
   b) 0
   c) -1
   d) -2
10) Which one of the following statements is true about the digital circuit shown in the figure



   a) It can be used for dividing the input frequency by 3.
   b) It can be used for dividing the input frequency by 5.
   c) It can be used for dividing the input frequency by 7.
   d) It cannot be reliably used as a frequency divider due to disjoint internal cycles.
11) Digital input signals A, B, C with A as the MSB and C as the LSB are used to realize the Boolean function $F = m_0 + m_2 + m_3 + m_5 + m_7$, where m_i denotes the i^{th} minterm. In addition, F has don't care for m_1. The simplified expression for F is given by
   a) $\overline{AC} + \overline{B}C + AC$
   b) $\overline{A} + C$
   c) $\overline{C} + A$
   d) $\overline{A}C + BC + A\overline{C}$
12) Consider the two continous-time signals defined below:

$$x_1(t) = \begin{cases} |t|, & -1 \le t \le 1 \\ 0, & \text{otherwise} \end{cases}, x_2(t) = \begin{cases} 1 - |t|, & -1 \le t \le 1 \\ 0, & \text{otherwise} \end{cases} \tag{12.1}$$

These signals are sampled with a sampling period of $T = 0.25$ seconds to obtain discrete-time signals $x_1[n]$ and $x_2[n]$, respectively. Which one of the following statements is true?
   a) The energy of $x_1[n]$ is greater than the energy of $x_2[n]$.
   b) The energy of $x_2[n]$ is greater than the energy of $x_1[n]$.
   c) $x_1[n]$ and $x_2[n]$ have equal energies.
   d) Neither $x_1[n]$ nor $x_2[n]$ is a finite-energy signal.
13) The signal energy of the continuous-time signal $x(t) = [(t-1)u(t-1)] - [(t-2)u(t-2)] - [(t-3)u(t-3)] + [(t-4)u(t-4)]$ is
   a) $\frac{11}{3}$
   b) $\frac{7}{3}$

c) $\frac{1}{3}$
d) $\frac{5}{3}$