2019 EE 14-26

AI24BTECH11031 - Shivram S

1) Which one of the following functions is analytic in the region $|z| \leq 1$?

a) $\frac{z^2-1}{z}$ b) $\frac{z^2-1}{z+2}$ c) $\frac{z^2-1}{z-0.5}$ d) $\frac{z^2-1}{z+j0.5}$

2) The mean-square of a zero-mean random process is $\frac{kT}{C}$, where k is Boltzmann's constant, T is the absolute temperature, and C is a capacitance. The standard deviation of the random process is

a) $\frac{kT}{C}$ b) $\sqrt{\frac{kT}{C}}$ c) $\frac{C}{kT}$ d) $\frac{\sqrt{kT}}{C}$

3) A system transfer function is $H(s) = \frac{a_1 s^2+b_1 s+c_1}{a_2 s^2+b_2 s+c_2}$. If $a_1 = b_1 = 0$, and all other coefficients are positive, the transfer function represents a

a) low pass filter
b) high pass filter
c) band pass filter
d) notch filter

4) The symbols a and T represent positive quantities, and $u(t)$ is the unit step function. Which one of the following impulse responses is NOT the output of a causal linear time-invariant system?

a) $e^{+at}u(t)$ c) $1 + e^{-at}u(t)$
b) $e^{-a(t+T)}u(t)$ d) $e^{-a(t-T)}u(t)$

5) A 5 kVA, 50 V/100 V, single-phase transformer has a secondary terminal voltage of 95 V when loaded. The regulation of the transformer is

a) 4.5% b) 9% c) 5% d) 1%

6) A six-pulse thyristor bridge rectifier is connected to a balanced three-phase, 50 Hz AC source. Assuming that the DC output current of the rectifier is constant, the lowest harmonic component in the AC input current is

a) 100 Hz b) 150 Hz c) 250 Hz d) 300 Hz

7) The parameter of an equivalent circuit of a three-phase induction motor affected by reducing the RMS value of the supply voltage at the rated frequency is

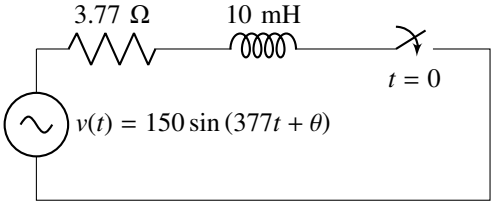
a) rotor resistance

b) rotor leakage reactance
c) magnetizing reactance
d) stator resistance

8) A three-phase synchronous motor draws 200 A from the line at unity power factor at rated load. Considering the same line voltage and load, the line current at a power factor of 0.5 leading is

a) 100 A b) 200 A c) 300 A d) 400 A

9) In the circuit shown below, the switch is closed at $t = 0$. The value of θ in degrees which will give the maximum value of DC offset of the current at the time of switching is



a) 60 b) -45 c) 90 d) -30

10) The output response of a system is denoted as $y(t)$, and its Laplace transform is given by

$$Y(s) = \frac{10}{s\left(s^2 + s + 100\sqrt{2}\right)}$$

The steady state value of $y(t)$ is

a) $\frac{1}{100\sqrt{2}}$ b) $10\sqrt{2}$ c) $\frac{1}{100\sqrt{2}}$ d) $100\sqrt{2}$

11) The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{\pi e^{-0.25s}}{s}.$$

In $G(s)$ plane, the Nyquist plot of $G(s)$ passes through the negative real axis at the point

a) $(-0.5, j0)$
b) $(-0.75, j0)$
c) $(-1.25, j0)$
d) $(-1.5, j0)$

12) The characteristic equation of a linear time-invariant (LTI) system is given by

$$\Delta(s) = s^4 + 3s^3 + 3s^2 + s + k = 0.$$

The system is BIBO stable if

a) $0 < k < \frac{12}{9}$
b) $k > 3$
c) $0 < k < \frac{8}{9}$
d) $k > 6$

13) Given V_{gs} is the gate-source voltage, V_{ds} is the drain-source voltage, and V_{th} is the threshold voltage of an enhancement type NMOS transistor, the conditions for the transistor to be biased in saturation are

a) $V_{gs} < V_{th}$; $V_{ds} \geq V_{gs} - V_{th}$
b) $V_{gs} > V_{th}$; $V_{ds} \geq V_{gs} - V_{th}$
c) $V_{gs} > V_{th}$; $V_{ds} \leq V_{gs} - V_{th}$
d) $V_{gs} < V_{th}$; $V_{ds} \leq V_{gs} - V_{th}$