GATE - EE - 2012 - 27 - 39

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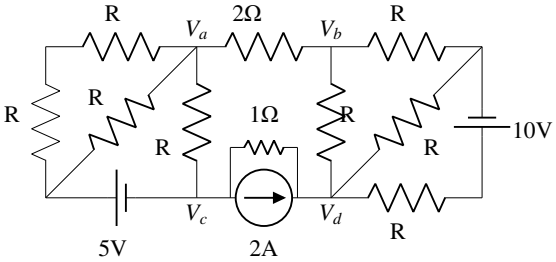
1) The maximum value of $f(x) = x^3 - 9x^2 + 24x + 5$ in the interval $[1, 6]$ is

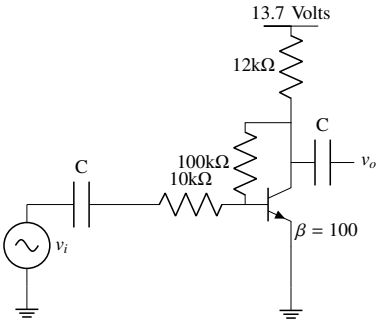
a) 21 b) 25 c) 41 d) 46

2) If $V_A - V_B = 6\,\text{V}$, then $V_C - V_D$ is



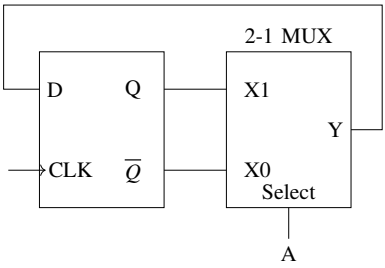
a) $-5\,\text{V}$ b) $2\,\text{V}$ c) $3\,\text{V}$ d) $6\,\text{V}$

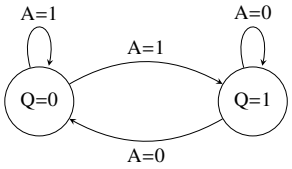
3) The voltage gain A_v of the circuit shown below is

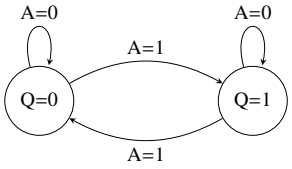


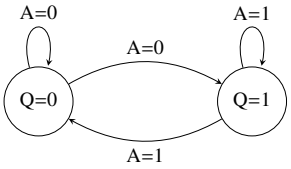
a) $|A_v| \approx 200$ b) $|A_v| \approx 100$ c) $|A_v| \approx 20$ d) $|A_v| \approx 10$

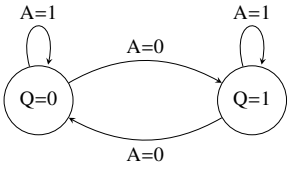
4) The state transition diagram for the logic circuit shown is



a)


b)


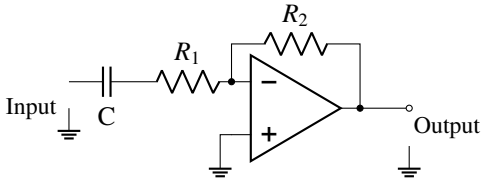
c)


d)


5) Let $y[n]$ denote the convolution of $h[n]$ and $g[n]$, where $h[n] = (1/2)^n u[n]$ and $g[n]$ is a causal sequence. If $y[0] = 1$ and $y[1] = 1/2$, then $g[1]$ equals

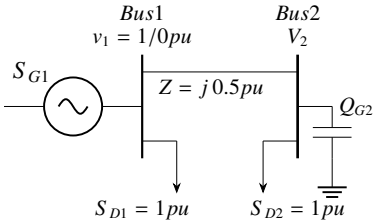
a) 0 b) $\frac{1}{2}$ c) 1 d) $\frac{3}{2}$

6) The circuit shown is a



a) low pass filter with $f_{3\text{dB}} = \frac{1}{(R_1+R_2)C}$ rad/s
b) high pass filter with $f_{3\text{dB}} = \frac{1}{R_1 C}$ rad/s
c) low pass filter with $f_{3\text{dB}} = \frac{1}{R_1 C}$ rad/s
d) high pass filter with $f_{3\text{dB}} = \frac{1}{(R_1+R_2)C}$ rad/s

7) For the system shown below, S_{D1} and S_{D2} are complex power demands at bus 1 and bus 2 respectively. If $|V_2| = 1$ pu, the VAR rating of the capacitor (Q_{G2}) connected at bus 2 is

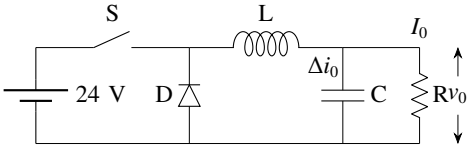


a) 0.2 pu b) 0.268 pu c) 0.312 pu d) 0.4 pu

8) A cylindrical rotor generator delivers 0.5 pu power in the steady-state to an infinite bus through a transmission line of reactance 0.5 pu. The generator no-load voltage is 1.5 pu and the infinite bus voltage is 1 pu. The inertia constant of the generator is 5 MW-s/MVA and the generator reactance is 1 pu. The critical clearing angle, in degrees, for a three-phase dead short circuit fault at the generator terminal is

a) 53.5 b) 60.2 c) 70.8 d) 79.6

9) In the circuit shown, an ideal switch S is operated at 100 kHz with a duty ratio of 50%. Given that Δi_c is 1.6 A peak-to-peak and I_0 is 5 A dc, the peak current in S is



a) 6.6 A b) 5.0 A c) 5.8 A d) 4.2 A

10) A 220 V, 15 kW, 1000 rpm shunt motor with armature resistance of 0.25 Ω, has a rated line current of 68 A and a rated field current of 2.2 A. The change in field flux required to obtain a speed of 1600 rpm while drawing a line current of 52.8 A and a field current of 1.8 A is

a) 18.18% increase
b) 18.18% decrease
c) 36.36% increase
d) 36.36% decrease

11) A fair coin is tossed till a head appears for the first time. The probability that the number of required tosses is odd, is

a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) $\frac{2}{3}$ d) $\frac{3}{4}$

12) The direction of vector $\mathbf{A}$ is radially outward from the origin, with $|\mathbf{A}| = kr^n$ where $r^2 = x^2 + y^2 + z^2$ and k is a constant. The value of n for which $\nabla \cdot \mathbf{A} = 0$ is

a) -2 b) 2 c) 1 d) 0

13) Consider the differential equation

$$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = \delta(t) \quad \text{with} \quad y(t)|_{t=0^-} = -2 \quad \text{and} \quad \left.\frac{dy}{dt}\right|_{t=0^-} = 0.$$

The numerical value of $\left.\frac{dy}{dt}\right|_{t=0^+}$ is

a) -2 b) -1 c) 0 d) 1