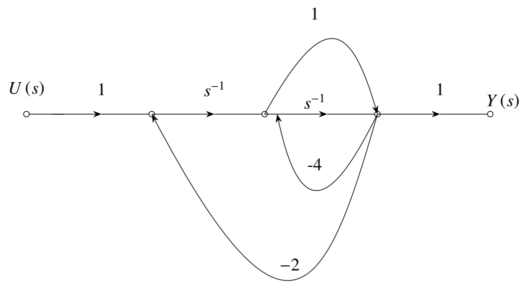
2013-EE-40-52

EE24BTECH11006 - Arnav Mahishi

1) The signal flow graph for a system in given below. The transfer function $\frac{Y(s)}{U(s)}$ for this system is.



a) $\frac{s+1}{5s^2+6s+2}$ b) $\frac{s+1}{s^2+6s+2}$ c) $\frac{s+1}{s^2+4s+2}$ d) $\frac{1}{5s^2+6s+2}$

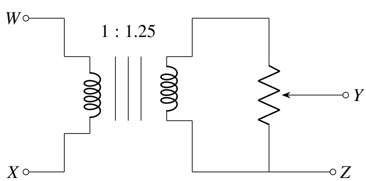
2) The impulse response of a continuous time system is given by $h(t) = \delta(t-1) + \delta(t-3)$. The value of the step response at $t = 2$ is.

a) 0 b) 1 c) 2 d) 3

3) Two magnetically uncoupled inductive coils have Q factors q_1 and q_2 at the chosen operating frequency. Their respective resistances are R_1 and R_2. When connected in series, their effective Q factor at the same operating frequency is.

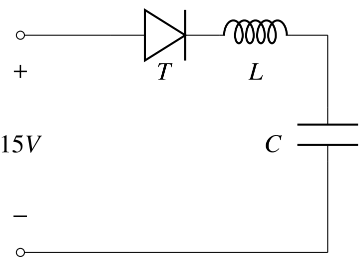
a) $q_1R_1 + q_2R_2$ b) $\frac{q_1}{R_2} + \frac{q_2}{R_2}$ c) $\frac{(q_1R_1+q_2R_2)}{(R_1+R_2)}$ d) $q_1R_2 + q_2R_1$

4) The following arrangement consists of an ideal transformer and an attenuator which attenuates by a factor o 0.8. An ac voltage $V_{WX1} = 100V$ is applied across WX to get an open circuit voltage V_{YZ1} across YZ. Next, an ac voltage $V_{YZ2} = 100V$ is applied across YZ to get an open circuit voltage V_{WX2} across WX. Then $\frac{V_{YZ1}}{V_{WX1}}, \frac{V_{WX2}}{V_{YZ2}}$



a) $\frac{125}{100}$ and $\frac{80}{100}$ b) $\frac{100}{100}$ and $\frac{80}{100}$ c) $\frac{100}{100}$ and $\frac{100}{100}$ d) $\frac{80}{100}$ and $\frac{80}{100}$

5) Thyristor T in the figure below is initially off and is triggered with a single pulse of width $10\mu s$. It is given that $L = \left(\frac{100}{\pi}\right) \propto H$ and $C = \left(\frac{100}{\pi}\right) \propto F$. Assuming latching and holding currents of the thyristor are both zero and the initial charge on C is zero, T conducts for



a) $10\mu s$ b) $50\mu s$ c) $100\mu s$ d) $200\mu s$

6) A 4-pole induction motor, supplied by a slightly unbalanced three-phase 50Hz source, is rotating at 1440rpm. The electrical frequency in Hz of the induced negative sequence current in the rotor is

a) 100 b) 98 c) 52 d) 48

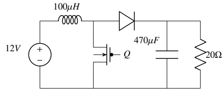
7) A function $y = 5x^2 + 10x$ is defined over an open interval $x = (1, 2)$. At least at one point in this interval, $\frac{dy}{dx}$ is exactly

a) 20 b) 25 c) 30 d) 35

8) When the Newton-Raphson method is applied to solve the equation $f(x) = x^3 + 2x - 1 = 0$, the solution at the end of the first iteration with the initial guess value as $x_o = 1.2$ is

a) -0.82 b) 0.49 c) 0.705 d) 1.69

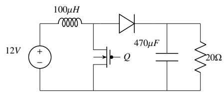
9) In the figure shown below, the chopper feeds a resistive load from a battery source. MOSFET Q is switched at 250kHz, with a duty ratio of 0.4. All elements of the circuit are assumed to be ideal.



The average source current in Amps in steady-state is

a) $\frac{3}{2}$ b) $\frac{5}{3}$ c) $\frac{5}{2}$ d) $\frac{15}{4}$

10) In the figure shown below, the chopper feeds a resistive load from a battery source. MOSFET Q is switched at 250kHz, with a duty ratio of 0.4. All elements of the circuit are assumed to be ideal.



The Peak-to-Peak source current ripple in Amps is

a) 0.96 b) 0.144 c) 0.192 d) 0.288

11) The state variable formulation of a system is given as
$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} u, x_1(0) = 0, x_2(0) = 0$ and $y = \begin{pmatrix} 1 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$

The system is

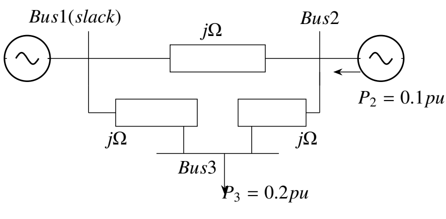
a) controllable but not observable
b) not controllable but observable
c) both controllable and observable
d) both not controllable and not observable

12) The state variable formulation of a system is given as
$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} -2 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} u, x_1(0) = 0, x_2(0) = 0$ and $y = \begin{pmatrix} 1 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$

The response $y(t)$ to a unit step input is

a) $\frac{1}{2} - \frac{1}{2}e^{-2t}$ b) $1 - \frac{1}{2}e^{-2t} - \frac{1}{2}e^{-t}$ c) $e^{-2t} - e^{-t}$ d) $1 - e^{-t}$

13) In the following network, the voltage magnitudes at all buses are equal to $1p.u$, the voltage phase angles are very small, and the line resistances are very negligible. All the line reactances are equal to $j\Omega$



a) $\theta_2 = -0.1, \theta_3 = -0.2$
b) $\theta_2 = 0, \theta_3 = -0.1$
c) $\theta_2 = 0.1, \theta_3 = 0.1$
d) $\theta_2 = 0.1, \theta_3 = 0.2$