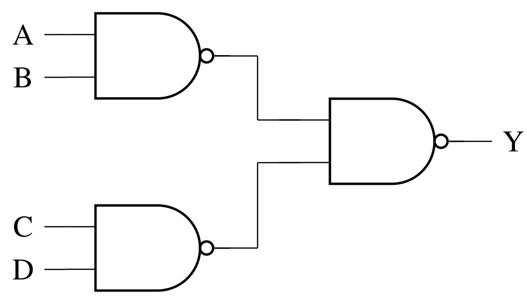
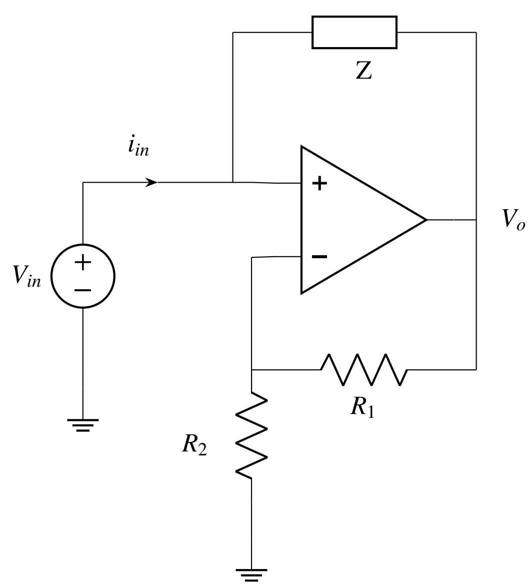
AE-2015 14-26

AI24BTECH11012- Pushkar Gudla

1) In the logic circuit shown in the figure, Y is given by



   a) Y=ABCD
   b) Y=(A+B)(C+D)
   c) Y=A+B+C+D
   d) Y=AB+CD
2) The op-amp shown in the figure is ideal. The input impedance $\frac{v_{in}}{i_{in}}$ is given by

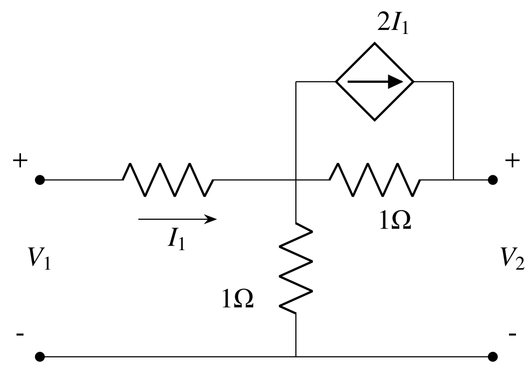


   a) $Z\frac{R_1}{R_2}$
   b) $-Z\frac{R_2}{R_1}$
   c) Z
   d) $-Z\frac{R_1}{R_1+R_2}$
3) A continuous-time input signal xt is an eigenfunction of an LTI system, if the output is
   a) kxt, where k is an eigenvalue
   b) $ke^{iwt}x(t)$ where k is an eigenvalue and e^{iwt} is a complex exponential signal
   c) $x(t)e^{iwt}$, where e^{iwt} is a complex signal
   d) $kH(w)$, where k is an eigenvalue and $H(w)$ is a frequency response of the system

4) Consider a non-singular $2x2$ square matrix $\mathbf{A}$. If $trace(\mathbf{A}) = 4$ and $trace\mathbf{A}^2 = 5$, the determinant of the matrix $\mathbf{A}$ is __________(up to 1 decimal place).

5) Let f be a real-valued function of a real variable defined as $f(x) = x - [x]$, where $[x]$ denoted the largest integer less than or equal to x. The value of $\int_{0.25}^{1.25} f(x)dx$ is __________(up to 2 decimal places).

6) In the two-port network shown, the h_{11} parameter ($where$, $\mathrm{h}_{11} = \frac{V_1}{I_1}$, when $V_2 = 0$ in ohms is __________(up to 2 decimal places).

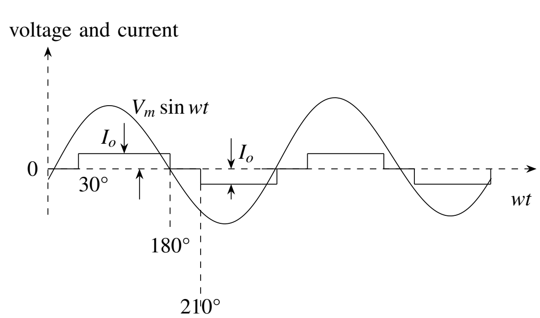


7) The series impedance matrix of a short three-phase transmission line in phase coordinates $\begin{bmatrix} Z_s & Z_m & Z_m \\ Z_m & Z_s & Z_m \\ Z_m & Z_m & Z_s \end{bmatrix}$ is given. If the positive sequence impedance is $(1 + j10)\Omega$, and the zero sequence impedance is $(4 + j31)\Omega$, then the imaginary part of Z_m (in Ω) is __________ (up to 2 decimal places).

8) The positive, negative and zero sequence impedances of a 125 MVA, three-phase, 15.5 kV, star-grounded, 50 Hz generator are $j0.1$ pu, $j0.05$ pu, and $j0.01$ pu respectively on the machine rating base. The machine is unloaded and working at the rated terminal voltage. If the grounding impedance of the generator is $j0.01$ pu, then the magnitude of fault current for a b-phase to ground fault (in kA) is __________ (up to 2 decimal places).

9) A 1000×1000 bus admittance matrix for an electric power system has 8000 non-zero elements. The minimum number of branches (transmission lines and transformers) in this system are __________(up to 2 decimal places).

10) The waveform of the current drawn by a semi-converter from a sinusoidal AC voltage source is shown in the figure. If $I_o = 20$A, the rms value of fundamental component of the current is __________A(up to 2 decimal places).



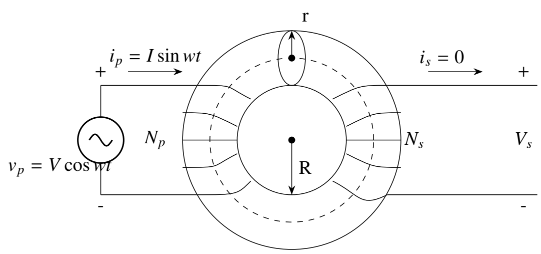
11) A separately excited dc motor has an armature resistance $R_a = 0.05\Omega$. The field excitation is kept constant. At an armature voltage of 100V, the motor produces a torque of 500 Nm at zero speed. Neglecting all mechanical losses, the no-load speed of the motor(in radian/s) for an armature voltage of 150 V is __________(up to 2 decimal places).

12) Consider a unity feedback system with forward transfer function given by

$$G(s) = \frac{1}{(s+1)(s+2)}$$

The steady-state error in the output of the system for a unit-step input is ________ (up to 2 decimal places).

13) A transformer with toroidal core of permeabiltiy μ is shown in the figure. Assuming uniform flux density across the circular core cross-section of radius $r < R$, and neglecting any leakage flux, the best estimate for the mean radius R is



a) $\frac{\mu V r^2 N_p^2 w}{I}$

b) $\frac{\mu I r^2 N_p N_s w}{V}$

c) $\frac{\mu V r^2 N_p^2 w}{2I}$

d) $\frac{\mu I r^2 N_p^2 w}{2V}$