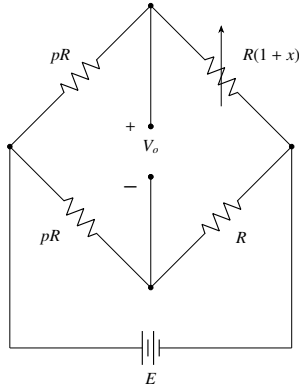
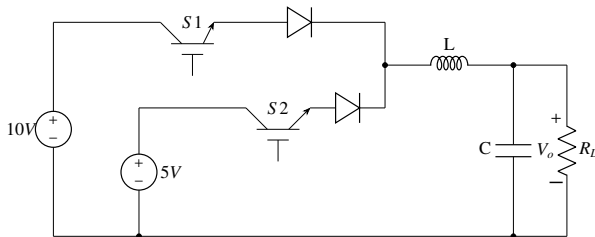


- 1) An unbalanced *DC* Wheatstone bridge is shown in the figure. At what value of p will the magnitude of V_o be maximum? (2015-EE)

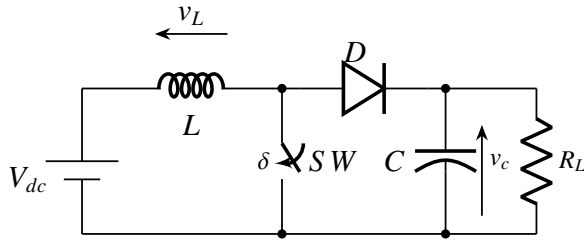


- a) $\sqrt{1+x}$ b) $(1+x)$ c) $\frac{1}{\sqrt{1+x}}$ d) $\sqrt{1-x}$

- 2) The circuit shown is meant to supply a resistive load R_L from two separate *DC* voltage sources. The switches S_1 and S_2 are controlled so that only one of them is ON at any instant. S_1 is turned on for $0.2ms$ and S_2 is turned on for $0.3ms$ in a $0.5ms$ switching cycle time period. Assuming continuous conduction of the inductor current and negligible ripple on the capacitor voltage, the output voltage V_o (in Volt) across R_L is _____.



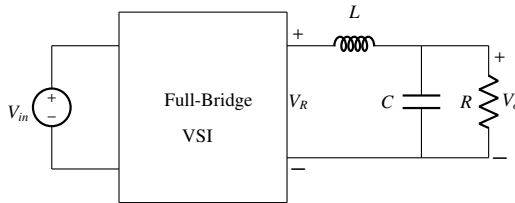
- 3) A self commutating switch SW operated at duty cycle δ is used to control the load voltage as shown in the figure



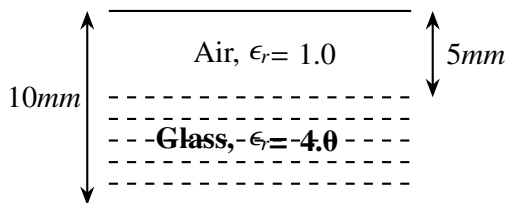
Under steady state operating conditions, the average voltage across the inductor and the capacitor respectively, are (2015-EE)

- a) $V_L = 0$ and $V_C = \frac{1}{1-\delta} V_{dc}$ c) $V_L = 0$ and $V_C = \frac{\delta}{1-\delta} V_{dc}$
 b) $V_L = \frac{\delta}{2} V_{dc}$ and $V_C = \frac{1}{1-\delta} V_{dc}$ d) $V_L = \frac{\delta}{2} V_{dc}$ and $V_C = \frac{\delta}{1-\delta} V_{dc}$

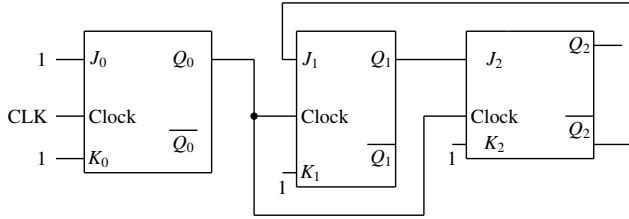
- 4) The single-phase full-bridge voltage source inverter (VSI) shown in figure, has an output frequency of 50Hz . It uses unipolar pulse width modulation with switching frequency of 50kHz and modulation index of 0.7 . For $V_{in} = 100\text{V}$, $L = 9.55\text{mH}$, $C = 63.66\mu\text{F}$ and $R = 5\Omega$ the amplitude of the fundamental component in the voltage V_o (in Volt) under steady-state is _____ (2015-EE)



- 5) A 3-phase 50Hz square wave (6-step) VSI feeds a 3-phase, 4 pole induction motor. The VSI line voltage has a dominant 5^{th} harmonic component. If the operating slip of the motor with respect to fundamental component voltage is 0.04 , the slip of the motor with respect to 5^{th} harmonic component of voltage is _____ (2015-EE)
- 6) A parallel plate capacitor is partially filled with glass of dielectric constant 4.0 as shown below. The dielectric strengths of air and glass are 30kV/cm and 300kV/cm , respectively. The maximum voltage (in kilovolts), which can be applied across the capacitor without any breakdown, is _____ (2015-EE)



- 7) The figure shows a digital circuit constructed using negative edge triggered $J - K$ flip flops. Assume a starting state of $Q_2Q_1Q_0 = 000$. This state $Q_2Q_1Q_0 = 000$ will repeat after _____ number of cycles of the clock CLK . (2015-EE)



- 8) $f(A, B, C, D) = \Pi M(0, 1, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15)$ is a maxterm representation of the Boolean function $f(A, B, C, D)$ where A is the MSB and D is the LSB. The equivalent minimized representation of this function is (2015-EE)
- $(A + \bar{C} + D)(\bar{A} + B + D)$
 - $A\bar{C}D + \bar{A} + B + D$
 - $\bar{A}CD + A\bar{B}CD + A\bar{B}\bar{C}\bar{D}$
 - $(B + \bar{C} + D)(A + \bar{B} + \bar{C} + D)(\bar{A} + B + C + D)$
- 9) Consider a discrete time signal given by

$$x[n] = (-0.25)^n u[n] + (0.5)^n u[-n - 1]$$

The region of convergence of its Z-transform would be (2015-EE)

- the region inside the circle of radius 0.5 and centered at origin
 - the region outside the circle of radius 0.25 and centered at origin
 - the annular region between the two circles, both centered at origin and having radii 0.25 and 0.5
 - the entire Z plane
- 10) The op-amp shown in the figure has a finite gain $A = 1000$ and an infinite input resistance. A step voltage $V_i = 1\text{mV}$ is applied at the input at time $t = 0$ as shown. Assuming that the operational amplifier is not saturated, the time constant (in millisecond) of the output voltage V_o is (2015-EE)

