Analog Electronic Circuits (EC2.103) : Quiz-1

[redacted]

Date : 21st April, 2022, Duration : 45 minutes, Max. Marks : 10

Instructions:

- Clearly write your assumptions (if any)
- Numerical answers must be correct upto **two places** of decimal to get any credit
- Refrain from copying
- You can use your lecture notebooks and own handwritten short notes in the exam hall
- Mobile phone, computers can not be used during exam

1. (a) For the network shown in figure 1, what is the value of $v_C(t)$ at t=∞? It is given that, at $t = 0^-, v_C(t) = 0$ V. [1 Mark]

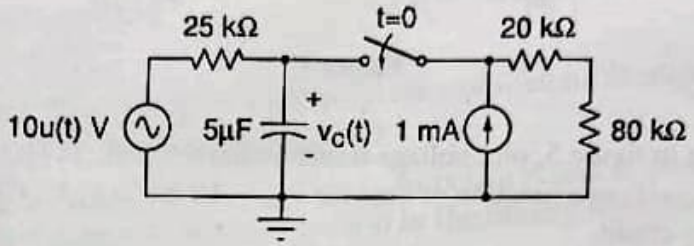


Figure 1

(b) What is the time constant τ for the circuit. [1 Mark]
(Hint: $\tau = R_{eq}C_{eq}$, where R_{eq} is the effective resistance across capacitor)

(c) Find the expression of voltage across capacitor ($v_c(t)$) as a function of time. [1 Mark]
(Hint: You can use $y(t) = y(\infty) + (y(0) - y(\infty))e^{-t/\tau}$)

(d) Find the value of $v_c(t)$ at t=200 ms. [1 Mark]
(answer must be correct upto two places of decimal)

(e) For the circuit shown in figure 2, $V_{in} = 1.8sin(2\pi 2000t)$ V. Plot V_D and report its minimum value. [1 Mark]

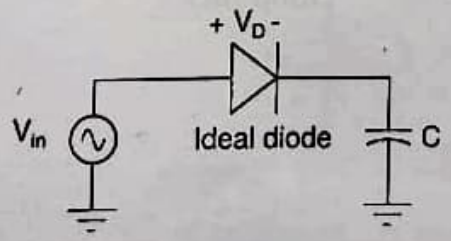


Figure 2

(f) For the circuit shown in figure 3, $V_0 = 5$ V. Find values of V_1 and V_2 correct upto two places of decimal. *(Hint: $I_D = I_0(e^{V_D/V_T} - 1)$, $V_T = 25$ mV at room temperature.)* [1 Mark]

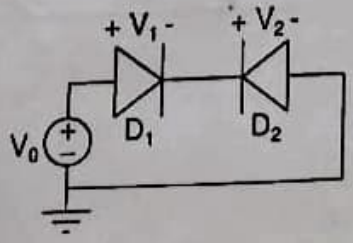


Figure 3

2. For the circuit shown in figure 4(a), it is given that $R_1 = 10\ M\Omega$, $C_1 = 2\ pF$, $R_2 = 5M\Omega$ and $C_2 = 50\ pF$. As shown in figure 4(b), an input step voltage V_{IN} is applied to the circuit. As shown in the figure, V_{IN} changes from $V_1 = 1$ V to $V_2 = 2$ V in $t_r = 10$ ps time. Find the values of $V_{C1}(t = 0-)$, $V_{C1}(t = 0+)$ and $I_{C1}(t = 0+)$. [2 Mark]
(Hint: You can assume t_r is very small and from $t = 0$ to $t = t_r$ all current flows through capacitors only. $I = Cdv/dt$)

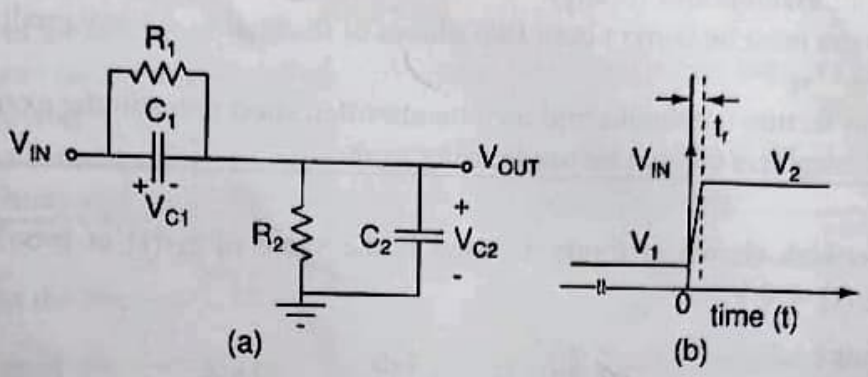


Figure 4

3. For the circuit shown in figure 5, plot voltage transfer characteristic (V_{OUT} vs V_{IN}) considering ideal diodes. Also plot $V_{OUT}(t)$ as a function of time for $V_{in} = 12sin(\omega_0 t)\ V$. Clearly label axis and values on all plots to get any credit. [2 Mark]

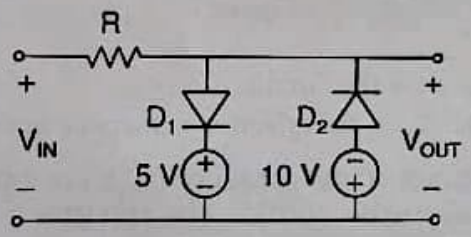
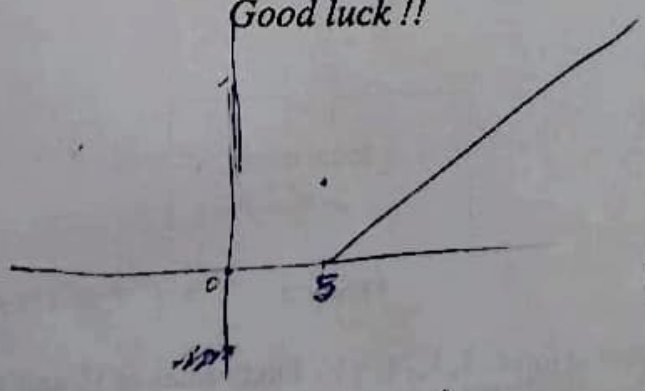
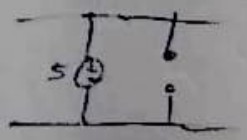


Figure 5

Good luck !!





$Q = CV$

$V = iR$

2×10^{-12} ×

$\frac{2 \times 50\ p^2}{52\ \Omega}$

$\frac{100}{52} \times 10^{-12}$

$\frac{1}{52} \times 10^{-10}$