Analog Electronic Circuits (EC2.103) : Quiz-1
Instructor: Prof. Abhishek Srivastava, CVEST, IIIT Hyderabad
Date : 30^{th} Jan, 2024, Duration : 1 hour, Max. Marks : 10

Instructions:
- Clearly write your valid assumptions (if any)
- You can use one A4 sheet own handwritten short notes in the exam hall
- Mobile phone, computers can not be used during exam

1. (a) Find $V_{C2}(t)$ as a function of time for the circuit given below in Fig. 1. Assume that C_2 was completely discharged at $t = 0^-$. [1 Mark]

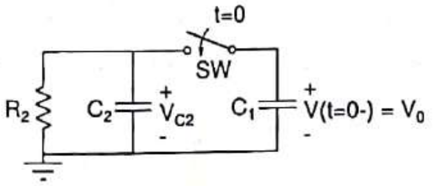

Figure 1

(b) I-V characteristic of a diode is shown in Fig. 2. Find dynamic resistance of the diode at points A and B as shown in the graph. [1 Mark]

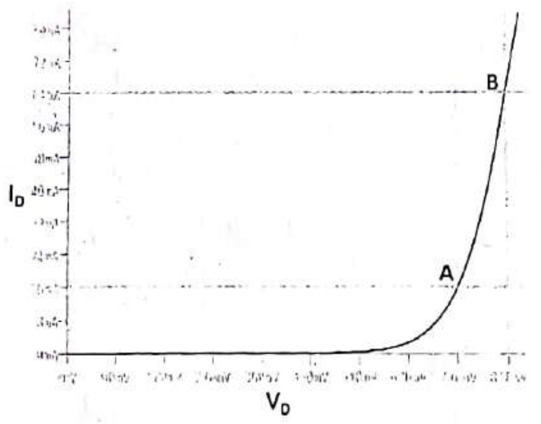

Figure 2

(c) Draw Bode magnitude and phase plots for the transfer function $H(s) = \frac{1}{(s+10)(s+50)}$. [1 Mark]

(d) For a uniformly doped n-type semiconductor bar having length of 2 μm and cross sectional area of 0.25 μm^2, find the drift current density (J) and total current (I) flowing through it, when a voltage of 1 V is applied across the bar. It is given that $N_D = 10^{16}/cm^3$, $n_i = 1.5 \times 10^{10}/cm^3$, $e = 1.6 \times 10^{-19}$ C and $\mu_n = 1350$ cm^2/VS. [2 Mark]

2. For the circuit shown in figure 3, find V_{out} for the two cases given below. Validate your assumptions (if any).

(a) $V_1 = 10$ V and $V_2 = 0$ V [1 Mark]

(b) $V_1 = 10$ V and $V_2 = 10$ V [1 Mark]

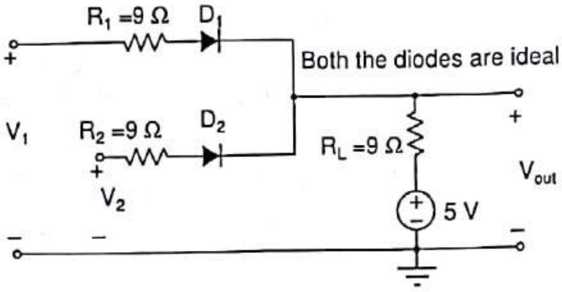

Figure 3

3. (a) For the circuit shown in figure 4(a), plot voltage transfer characteristic (V_{OUT} vs V_{IN}) considering ideal diodes. Also plot $V_{OUT}(t)$ as a function of time for $V_{in} = 20cos(\omega_0 t)\ V$. Clearly label axis and values on all plots to get any credit. [1 Mark]

   (b) For the circuit shown in figure 4(b), prove that both the diodes remain on for all values of input voltage. Considering diode cut-in voltage V_γ and on resistance R_{on}, derive V_{OUT} as a function of V_{IN}. [2 Mark]

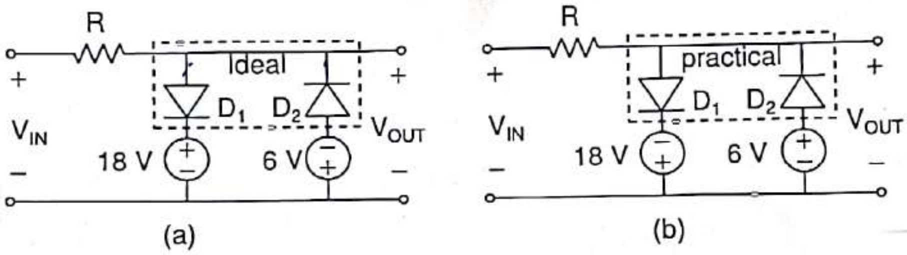

Figure 4

Good luck !!