

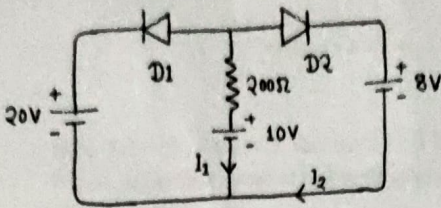
Tashyab Raj

Indian Institute of Information Technology Guwahati  
Mid-Semester Exam  
EC103: Basic Electronics Circuits

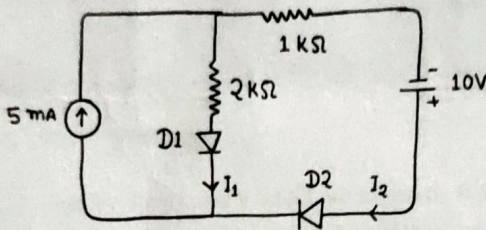
Total Marks: 35

Duration: 2 Hours

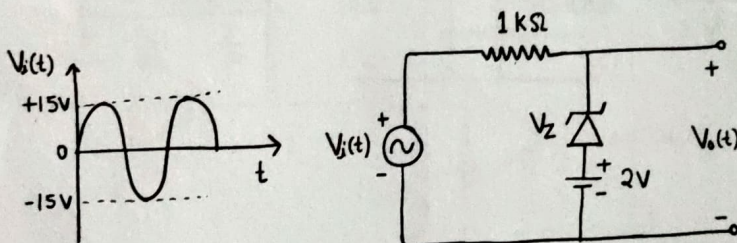
Q.1: In the given circuit, determine the currents  $I_1$  and  $I_2$ ? (Given that the cut-in voltage of each diode is 0.5 V.) [Marks = 1]



Q.2: In the given circuit, determine the currents  $I_1$  and  $I_2$ ? (Given that the cut-in voltage of each diode is 0.5 V.) [Marks = 3]



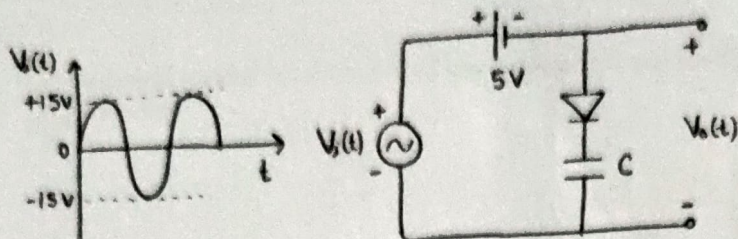
Q.3: In the given circuit, (i) cut-in voltage of Zener diode is 0.7 V, (ii)  $V_Z = 7$  V, and (iii)  $I_{ZM} = 50$  mA. Determine (a) the minimum value of output voltage ( $V_o(t)$ )? and (b) the maximum value of output voltage ( $V_o(t)$ )? [Marks = 3]



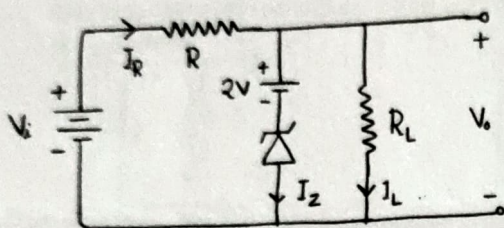
~~Handwritten scribbles and crossed-out text at the bottom of the page.~~



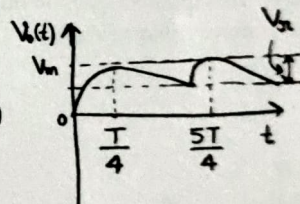
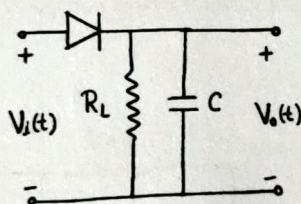
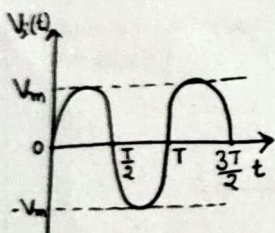
- Q.4: In the given circuit, cut-in voltage of diode is 0.5 V. Determine (a) the minimum value of output voltage ( $V_o(t)$ )? and (b) the maximum value of output voltage ( $V_o(t)$ )? [Marks = 3]



- Q.5: In the given circuit, determine  $I_R$ ,  $I_Z$ ,  $I_L$ ,  $V_o$ , and  $P_Z$ . Given that  $V_i = 20$  V,  $R = 500$  ohm,  $R_L = 1500$  ohm,  $V_Z = 10$  V, and  $P_{ZM} = 50$  mW. (Here,  $P_Z$  denotes the power dissipated in Zener diode.) [Marks = 5]



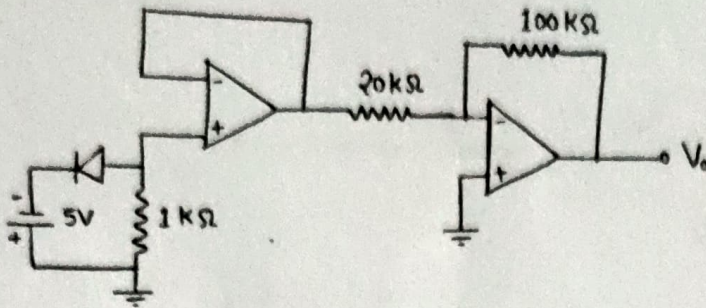
- Q.6: A halfwave rectifier with capacitive filter is shown in the figure where ripple voltage ( $V_r$ ) =  $\{V_o(t)\}_{max} - \{V_o(t)\}_{min}$ . Prove that  $V_r = \frac{V_m T}{R_L C}$ . (Given that  $R_L C \gg T$ .) [Marks = 3]





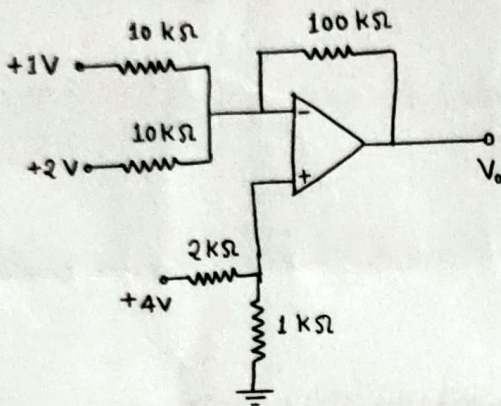
Q.7: In the given circuit, op-amps are ideal and cut-in voltage of diode is 0.5 V. Find  $V_o$ ?

[Marks = 3]



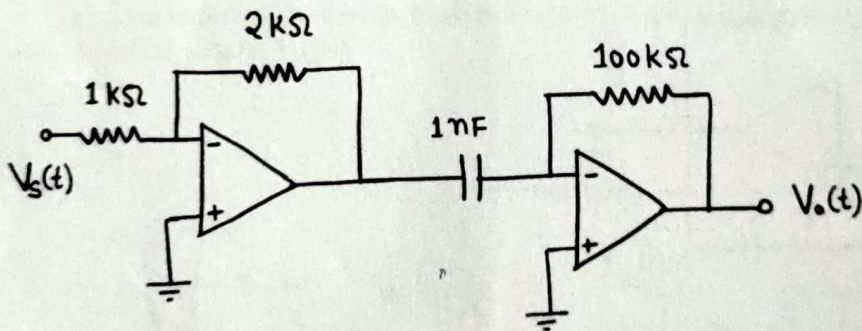
Q.8: Find  $V_o$ ? (Assume that the op-amp is ideal.)

[Marks = 3]



Q. 9: In the given circuit, op-amps are ideal and  $V_s(t) = 2\sin 2t$  volts. Find  $V_o(t)$ ?

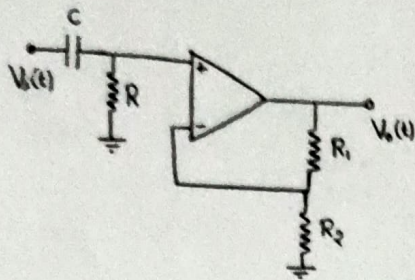
[Marks = 3]





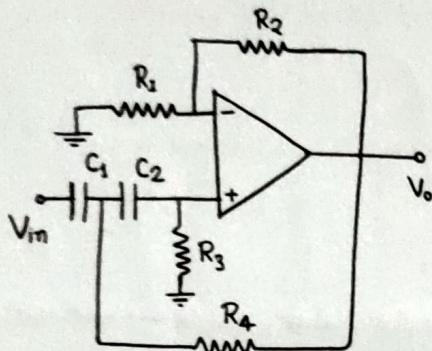
Q.10: Prove that the cut-off (3-dB) frequency of the following filter is  $1/RC$  radian/second.

[Marks = 3]



Q.11: Determine the type of the following filter?

[Marks = 2]



Q.12: A Wein-bridge oscillator is shown in the figure where  $R = 10^5 \Omega$ ,  $C = 10^{-9} \text{ F}$ , and  $R_1 = 10^3 \Omega$ . Determine the frequency of oscillation  $\omega$  (in radian/second) and  $R_F$ ? (Given that the feedback factor  $(\beta) = 1/3$ .)

[Marks = 3]

