

# Electrical Sciences-EE101

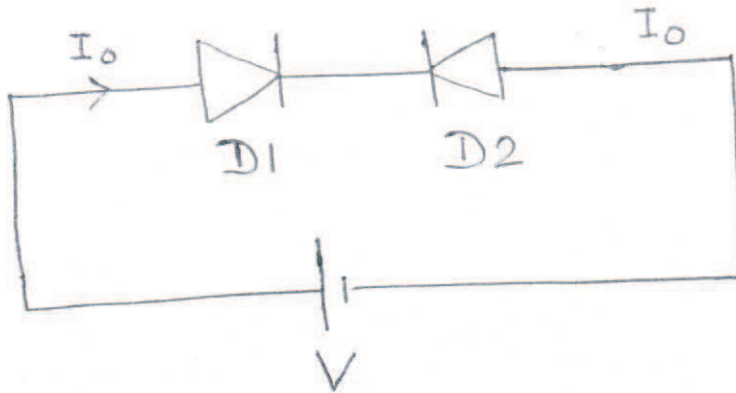
Mid-Semester Exam

FM: 30; Time: 2 hours

Q.1 (a) Two ideal diodes with ideality factor  $\eta=1$  are connected back to back as shown below.

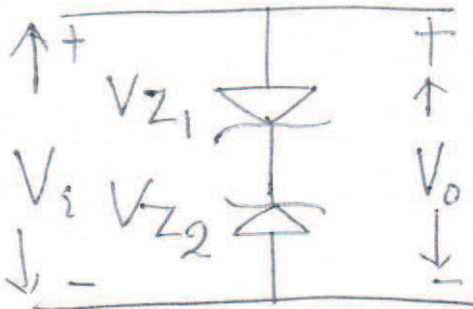
5

- (i) Show that  $\exp \frac{qV_1}{KT} + \exp \frac{-qV_2}{KT} = 2$ ; where  $V_1$  and  $V_2$  are voltages drops across diodes.  
 (ii) Assuming that reverse biased diode is saturated at  $I_0$ , Calculate the voltage drop across the forward biased diode ( $KT/q=25$  mV).



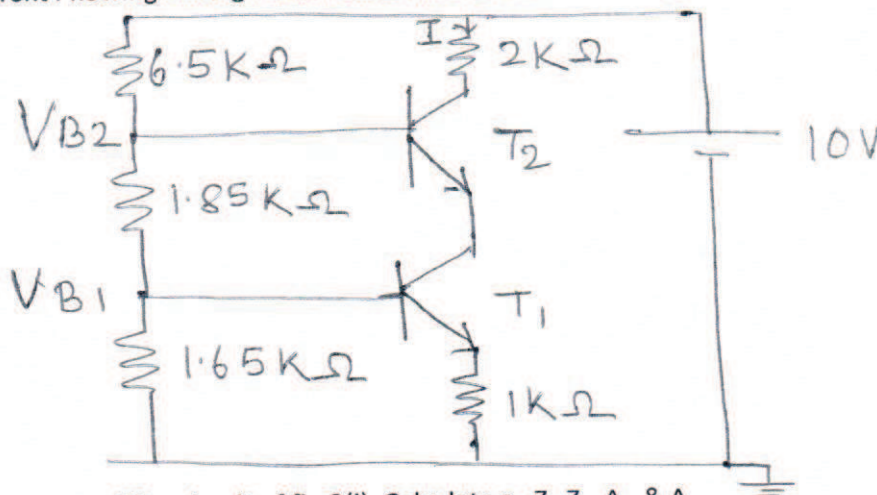
- (b) A zener diode acts as a voltage regulator. Explain the meaning of this sentence.  
 (c) Plot  $V_0$  vs.  $V_i$  for the circuit given below.

1  
2



(d) Obtain current  $I$  flowing through  $2K\Omega$  resistor, if transistors have high value of  $\beta$  and  $V_{BE}=0.65V$

3



- Q.2 (a) For given amplifier circuit of fig-2(i), Calculate  $r_e$ ,  $Z_i$ ,  $Z_o$ ,  $A_v$ , &  $A_i$ .  
 (b) For given amplifier circuit of fig-2(ii) determine  $I_E$ ,  $V_C$ , &  $V_{CE}$ .

5  
3

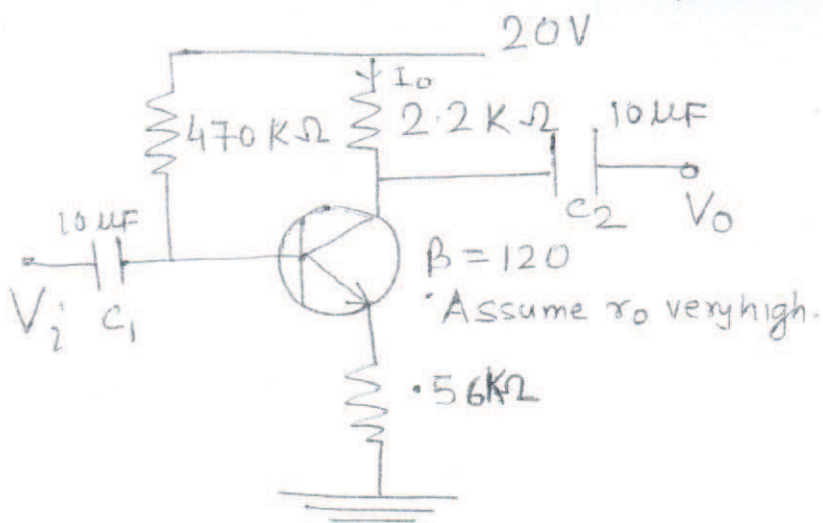


Fig 2(i)

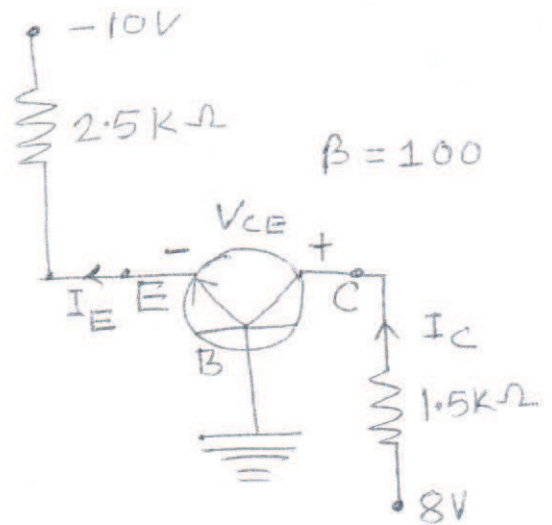
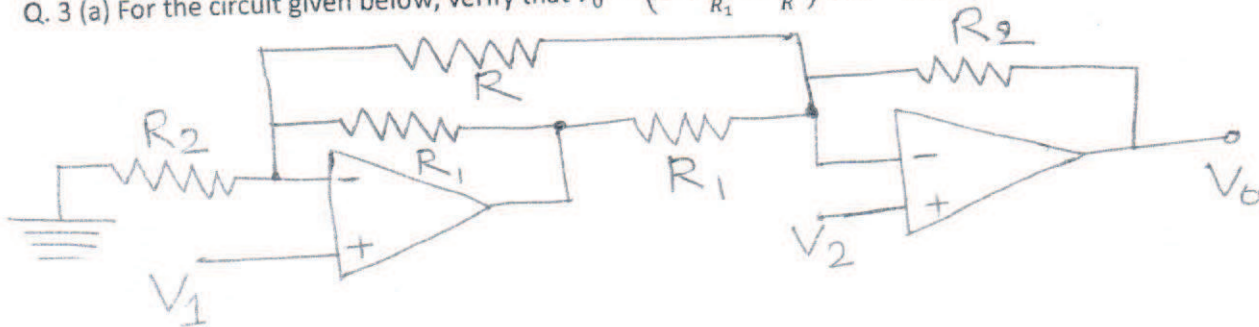
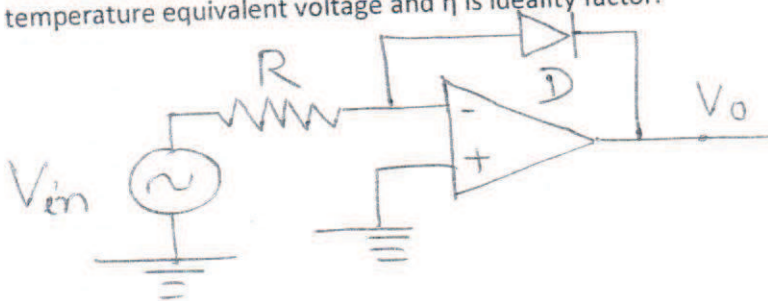


Fig 2(ii)

Q. 3 (a) For the circuit given below, verify that  $V_0 = \left(1 + \frac{R_2}{R_1} + \frac{2R_2}{R}\right)(V_2 - V_1)$



(b) For the circuit given below, derive  $V_0 = \eta V_T \ln(V_{in}/I_S)$ ; where  $I_S$  is reverse saturation current of diode,  $V_T$  is temperature equivalent voltage and  $\eta$  is ideality factor.



Q.4 (a) What is controlled source. Implement various kinds of sources using OP-AMP.  
(b) For OP-AMP circuit given below, find  $V_0(t)$ . Assume capacitor initially uncharged.

