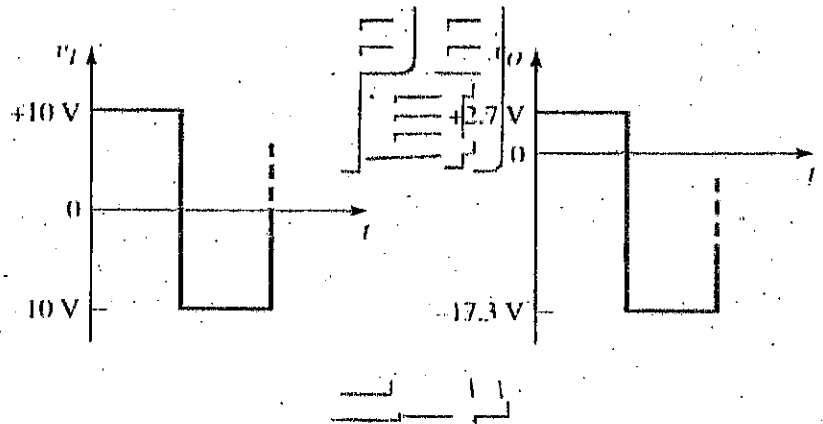
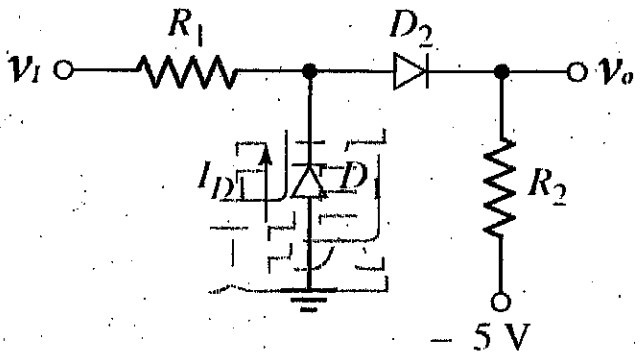
1. (a)What is the approximation electron concentration of the N-type Si in terms of the impurity concentration? ( 4 % )
   (b) What is the approximation hole concentration of the P-type Si in terms of the impurity concentration? ( 4 % )
   (c) How is the built-in potential barrier in a pn junction formed? ( 4 % )
   (d) What is Schottky barrier diode? How dose it differ from a pn junction diode? ( 4 % )
   (e) Describe a simple full-wave diode rectifier circuit. Assume the input signal is sinusoidal, sketch the output voltage versus time. ( 4 % )

2. Design a diode clamper to generate a steady-state output voltage $v_o$ from the input signal $v_I$ shown.
   (a) Assume the cut-in voltage of the diode $V_\gamma = 0$. ( 10% )
   (b) Assume the cut-in voltage of the diode $V_\gamma = 0.7$ V. ( 10% )



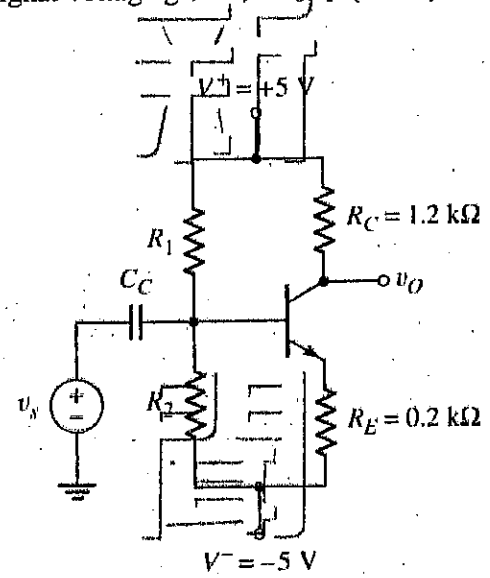

3. Assume each diode cut-in voltage is $V_\gamma = 0$, $R_1 = 10$ kΩ and $R_2 = 5$ kΩ. Plot the voltage transfer characteristics $v_o$ versus $v_I$. Indicate the breakpoints and give the state of each diode in the various region of the plot. ( 20% )



4. For the transistor in the circuit shown, assume $\beta = 150$, $V_A = \infty$.

(a)Determine $R_1$ and $R_2$ to obtain a bias-stable circuit with the Q-point in the center of the load line. ( 10% )

(b)Determine the small-signal voltage gain $A_v = v_o/v_s$. ( 10% )




5. The small-signal parameters of the transistor shown are $g_m = 2$ mA/V and $r_o = \infty$.

(a) What is the value of $R_D$ if the voltage gain is found to be $A_v = V_o/V_i = -15$ with $R_S = 0$. ( 10% )

(b) What is the value of $R_S$ if the voltage gain is reduced to $A_v = -5$ with the $R_D$ found in (a). ( 10% )