

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- (a). Describe the concepts of **drift** (3%) and **diffusion** (3%) currents in a semiconductor material.; (b). Compare the **pn junction**, **light-emitting**, **Zener**, and **Schottky barrier** diodes in terms of diode manufacturing, i - v characteristics, and applications. (12%);(c). Determine the diode current I_D and diode voltage V_D for the circuit in **Figure 1**, assume cut-in voltage V_Y is 0.7 V. (6%); (d). Design a diode clamper circuit to generate a steady-state output voltage v_o from the input voltage v_i in **Figure 2** if $V_Y = 0.7$ V. (6%)
- For the circuit in **Figure 3**, the transistor parameters are: $V_{TP} = -2$ V, $K_p = 0.5$ mA/V², $\lambda = 0$, (a). Draw the DC equivalent circuit and midband small-signal equivalent circuit (10%); (b). Determine the midband gain (6%) and R_o (6%); (c). Determine C_c such that the lower 3dB frequency is 20 Hz. (4%)
- The parameters of the transistor in the circuit in **Figure 4** are $\beta = 100$, $V_{BE(on)} = 0.7$ V, and $V_A = \infty$. Neglect the capacitance effects of the transistor. (a) Draw the three equivalent circuits that represent the amplifier in the low-frequency range, midband range, and the high frequency range. (12%); (b). Determine the values of midband gain $|A_m|$ in dB(6%) and cutoff frequencies f_L and f_H (6%); (c). Sketch the Bode magnitude plot. (5%)
- Design an amplifier with the band gain of 20dB, and bandpass filter capable of rejecting 60 Hz noise and signals higher than 1.5kHz. Please design your amplifier using operational amplifier, resistors, and capacitors. Plot your circuit and provide values of your devices. (15%)

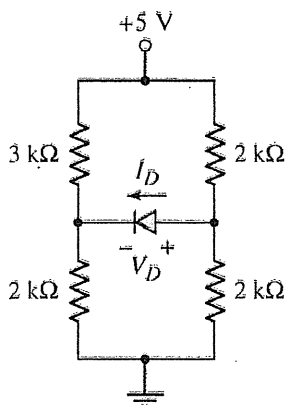


Figure 1

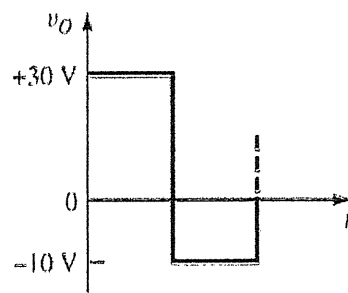


Figure 2

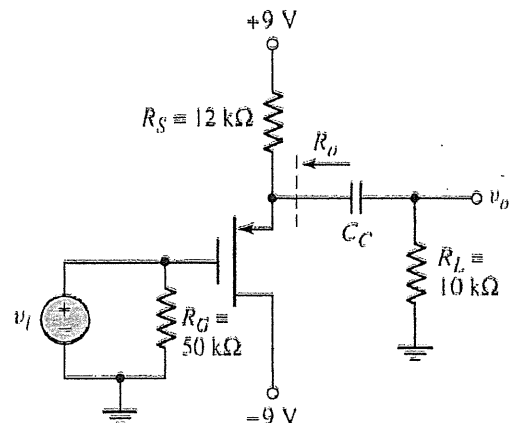


Figure 3

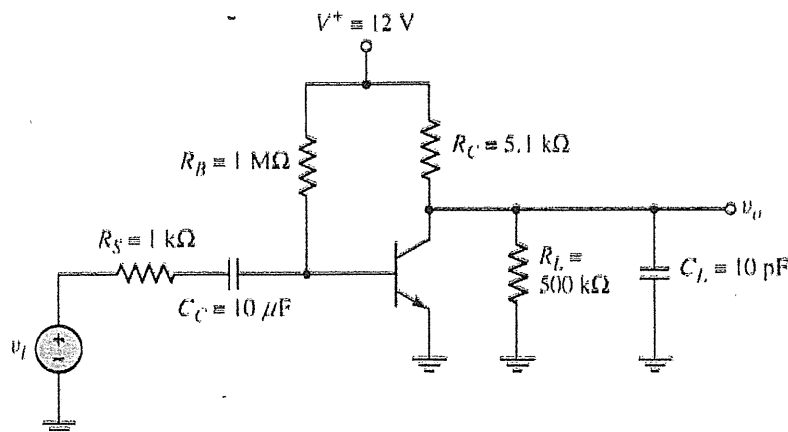


Figure 4