

# 國立成功大學

## 112學年度碩士班招生考試試題

編 號：158

系 所：生物醫學工程學系

科 目：電子學

日 期：0206

節 次：第 2 節

備 註：可使用計算機

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

1. (20%) Please explain the following terminologies:
  - a) depletion region (4%), b) emitter-coupled logic (ECL) (4%), c) emitter resistance (4%), d) frequency response of amplifiers (4%), e) dominant pole (4%).
2. (25%) For the circuits shown in Figure 1. Please answer the following questions
  - (a) Please derive the mid-band gain of the circuit (7%)
  - (b) Please derive transfer function in the low-frequency band (8%)
  - (c) Please determine the 3-dB frequency in the high-frequency band (10%)

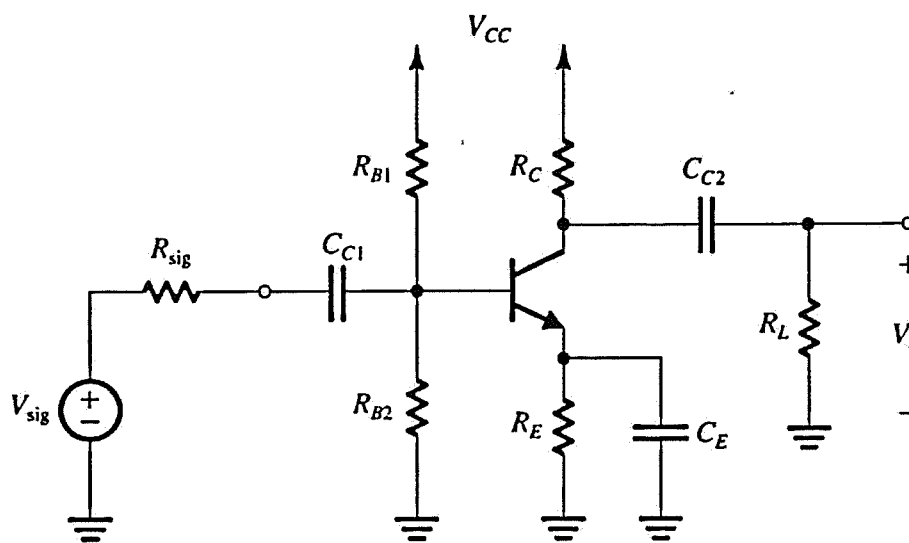


Figure 1

3. (20%) Please derive input resistance (4%), gain (8%), and output resistance (8%) of the circuit shown in Figure 2.

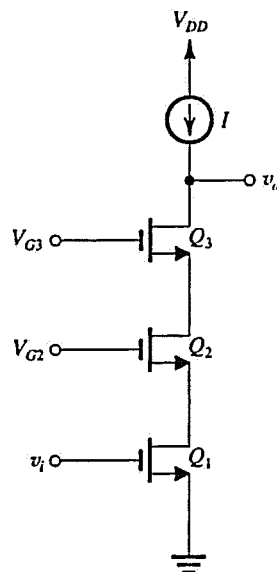


Figure 2

4. (10%) What is the peak inverse voltage of the circuit shown in Figure 3?

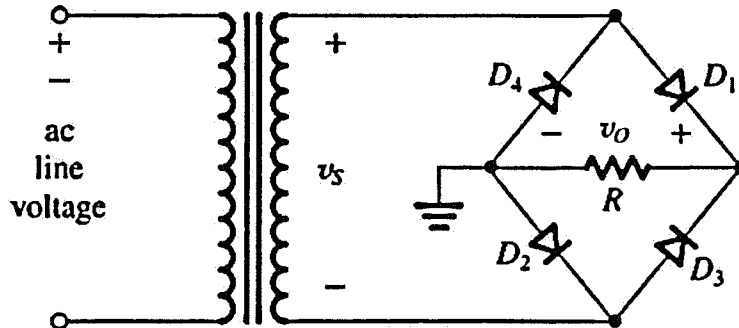


Figure 3

5. (25%) Figure 4 shows a discrete-circuit amplifier. The input signal  $v_{sig}$  is coupled to the gate through a very large capacitor (shown as infinite). The transistor source is connected to ground at signal frequencies via a very large capacitor (shown as infinite). The output voltage signal that develops at the drain is coupled to a load resistance via a very large capacitor (shown as infinite). All capacitors behave as short circuits for signals and as open circuits for DC.

(a) If the transistor has  $V_t = 1\text{ V}$ , and  $k_n = 4\text{ mA/V}^2$ , verify that the bias circuit establishes  $V_{GS} = 1.5\text{ V}$ ,  $I_D = 0.5\text{ mA}$ , and  $V_D = +0.7\text{ V}$ . That is, assume these values, and verify that they are consistent with the values of the circuit components and the device parameters. (5%)

(b) Find  $g_m$  and  $r_o$  if  $V_A = 100\text{ V}$ . (5%)

(c) Draw a complete small-signal equivalent circuit for the amplifier, assuming all capacitors behave as short circuits as signal frequencies. (5%)

(d) Find  $R_{in}$ ,  $v_{gs}/v_{sig}$ ,  $v_o/v_{gs}$ , and  $v_o/v_{sig}$ . (10%)

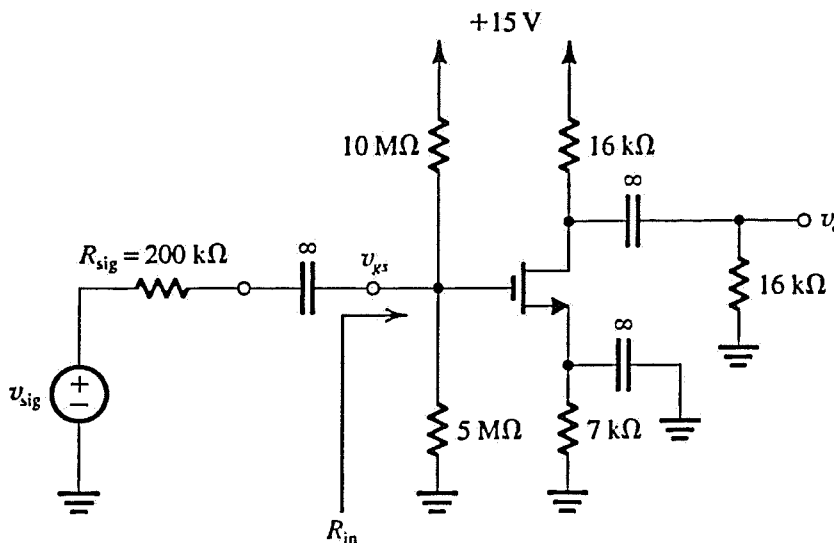


Figure 4