國立成功大學

113學年度碩士班招生考試試題

編　號：127

系　所：系統及船舶機電工程學系

科　目：電子學

日　期：0201

節　次：第 2 節

備　註：可使用計算機

編號： 127

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※ 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. The circuit in Fig. 1 utilizes an ideal op amp. (20%)
   (a) Find I_1, I_2, I_3, I_L, and V_X.
   (b) If V_0 is not to be lower than -13 V, find the maximum allowed value for R_L.
   (c) If R_L is varied in the range 100Ω to 1 kΩ, what is the corresponding change in I_L, and in V_o?

2. In the Fig. 2, Design a diode voltage regulator to supply 1.5 V to a 1.5 kΩ load. Use two diodes specified to have a 0.7V drop at a current of 1mA. The diodes are to be connected to a +5V supply through a resistor R. **Specify the value for R.** (a)What is the diode current with the load connected? (b)What is the increase resulting in the output voltage when the load is disconnected? (c)What change results if the load resistance is reduced to 1kΩ? (Hint: Use the small-signal diode model to calculate all changes in output voltage.) (20%)

3. The MOSFET in Fig. 3 has V_t=0.4V, k_n'=500μA/V^2 and λ=0. Find the required values of W/L and of R so that when $v_I = V_{DD}$ = +1.3V, r_{DS}=50Ω and v_0 =50mV. (20%)

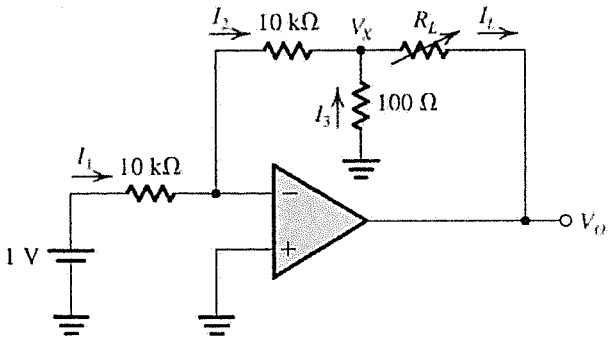

Fig. 1

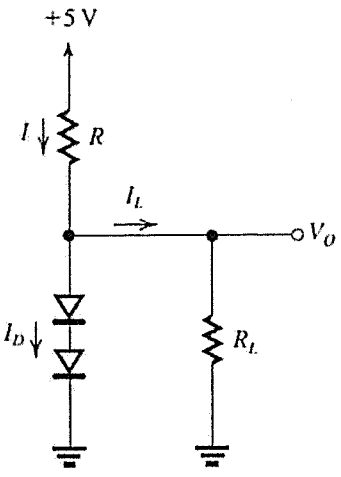

Fig. 2

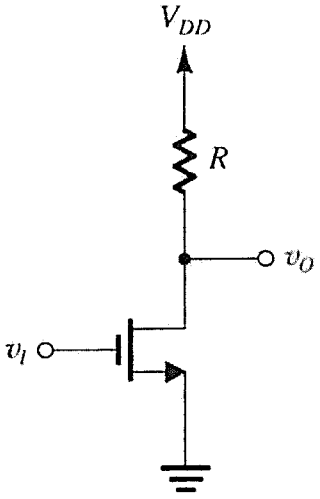

Fig. 3

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4. The amplifier of Fig. 4 consists of two identical common-emitter amplifiers connected in cascade. Observe that the input resistance of the second stage, R_{in2}, constitutes the load resistance of the first stage. (20%)
   (a) For V_{CC}=15V, R_1=100kΩ, R_2=47kΩ, R_E=3.9kΩ, R_C=6.8kΩ, and β=100, determine the dc collector current and dc collector voltage of each transistor.
   (b) Find R_{in1} and v_{b1}/v_{sig} for R_{sig} = 5 kΩ.
   (c) Find R_{in2} and v_{b2}/v_{b1}.
   (d) Find the overall voltage gain v_o/v_{sig} for R_L=2 kΩ.

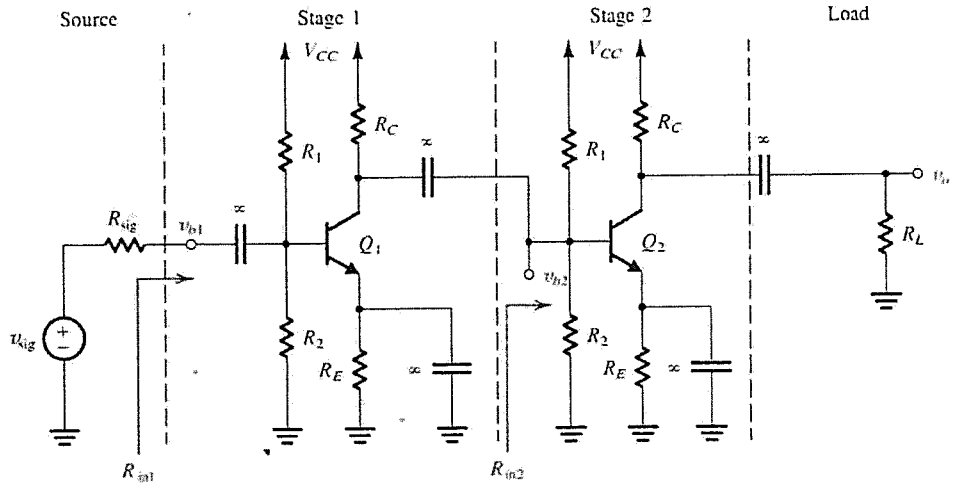

Fig. 4

5. The amplifier in Fig. 5 is biased to operate at g_m=2mA/V. Neglect r_o. (20%)
   (a) Determine the value of R_D that results in a midband gain of -20 V/V.
   (b) Determine the value of C_S that results in a pole frequency of 100 Hz.
   (c) What is the frequency of the transmission zero introduced by C_S ?
   (d) Give an approximate value for the 3 dB frequency f_L

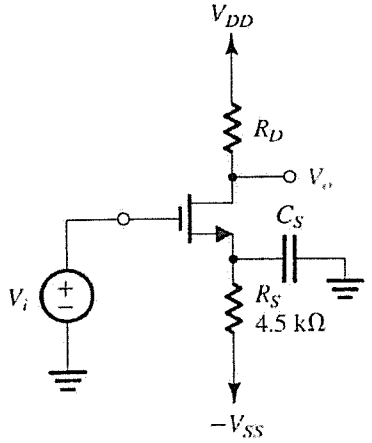

Fig. 5