

國立臺北大學九十七學年度碩士班招生考試試題

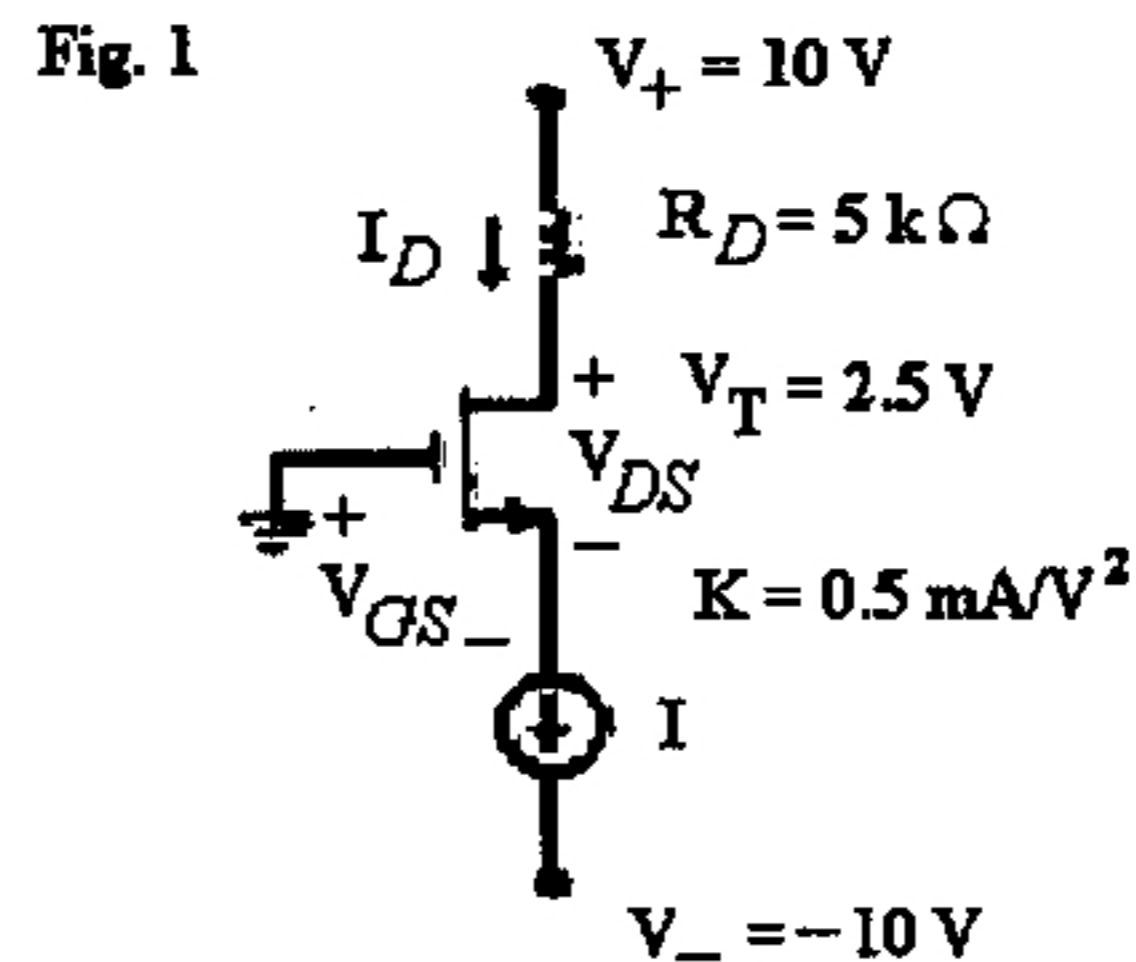
系(所)別：電機工程研究所
 科目：類比電子學

組別：甲組(晶片設計組)

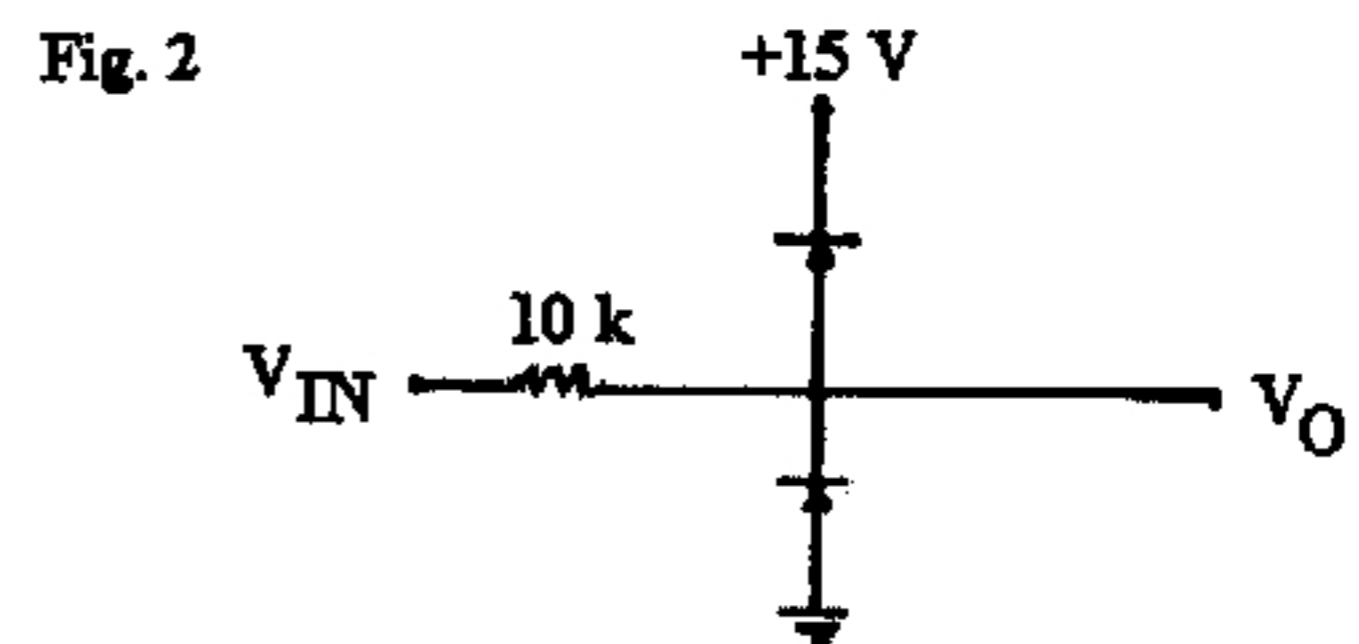
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可 不可使用計算機

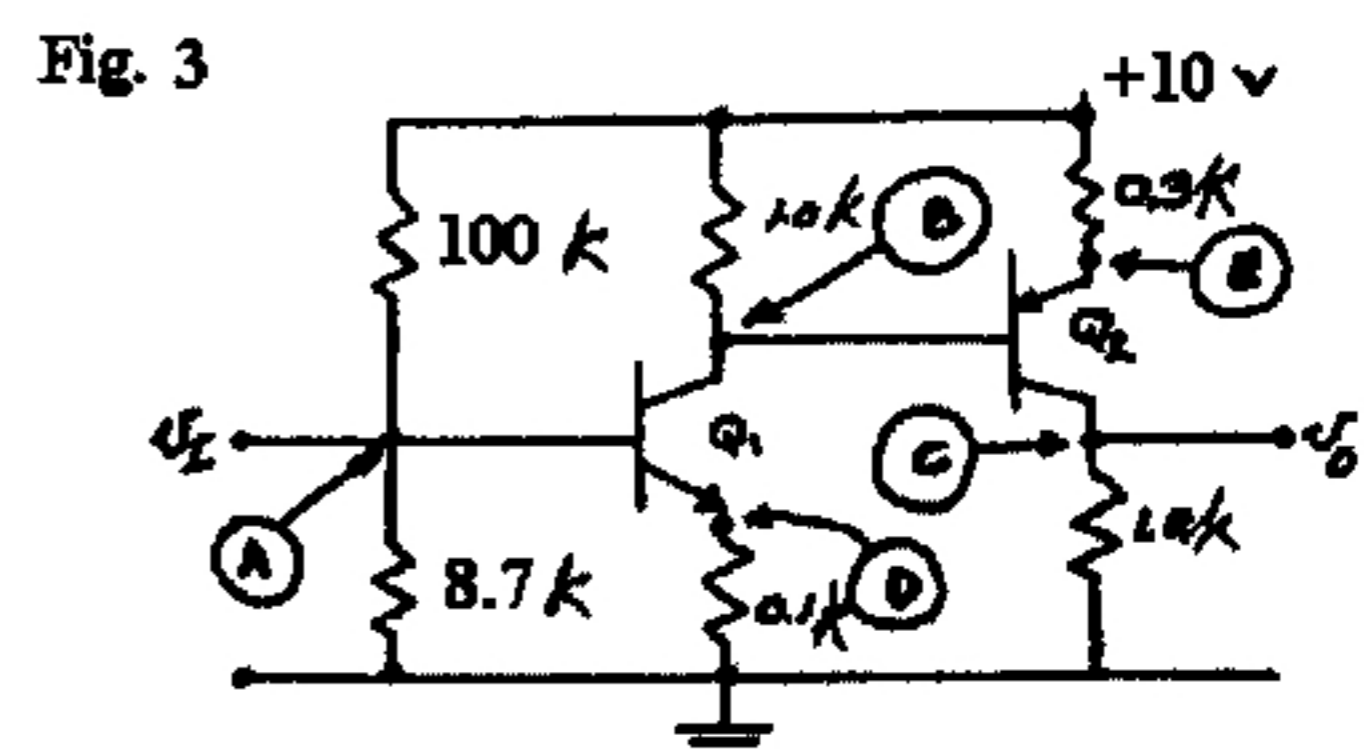
1. For the MOSFET shown in Fig.1 (a) what is the value of I that causes the MOSFET to drop into the ohmic region?
 (b) with $I = 1 \text{ mA}$ determine V_{GS} and V_{DS} (10%)



2. In Fig. 2 the diodes have $V_{D(on)} = 0.7 \text{ volt}$. Plot and label completely V_o for V_{in} between -5 and $+25$ volts. (10%)



3. In the amplifier shown in Fig. 3, Q1 is npn and Q2 is pnp. Take careful note of the subscripts given here in the following; $V_{BE1} = V_{EB2} = 0.7 \text{ V}$. Neglect dc base currents (I_B is close to zero) and (a) find the dc voltage at nodes A, B, C, D, and E. Fill in the circles above with the correct voltage with respect to ground. (b) What values did you find for the collector currents? (c) Are the transistors Q1 and Q2 active or saturated. (15%)



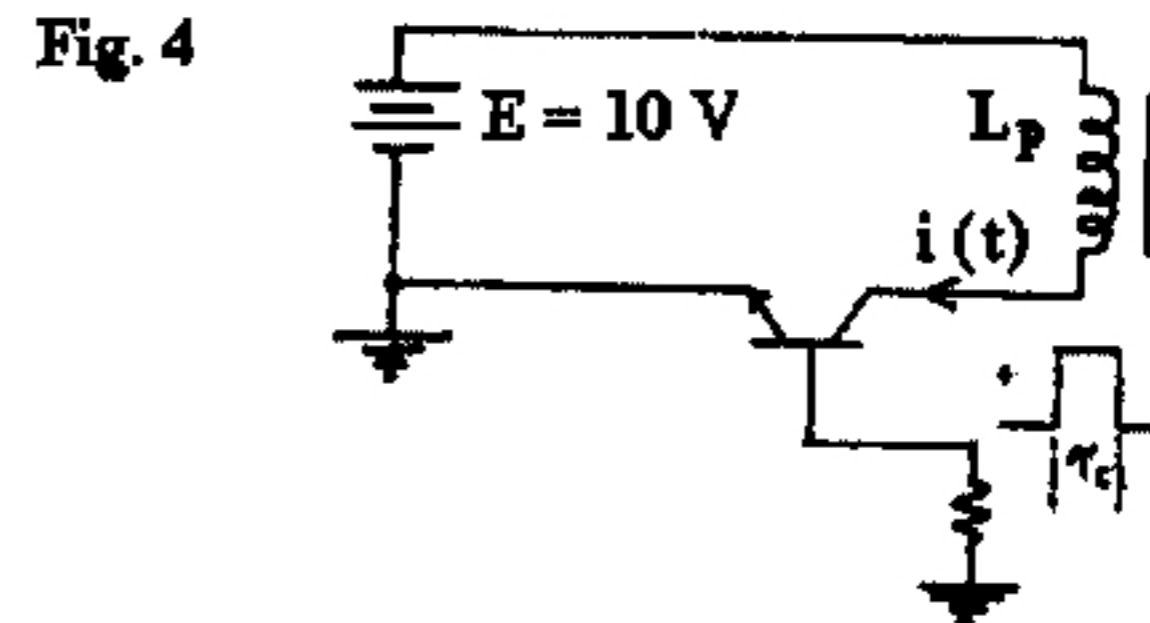
4. (a) What is channel length modulation effect?
 (b) For a particular n-channel MOS technology, in which the minimum channel length (L) is $1 \mu\text{m}$, the associated value of λ is 0.01 V^{-1} . If a particular device for which L is $3 \mu\text{m}$ operates at $V_{ds} = 1 \text{ V}$ with a drain current of $80 \mu\text{A}$, what does the drain current become if V_{ds} is raised to 3 V ? What percentage change does this represent? What can be done to reduce the percentage by a factor of 5? (10%)

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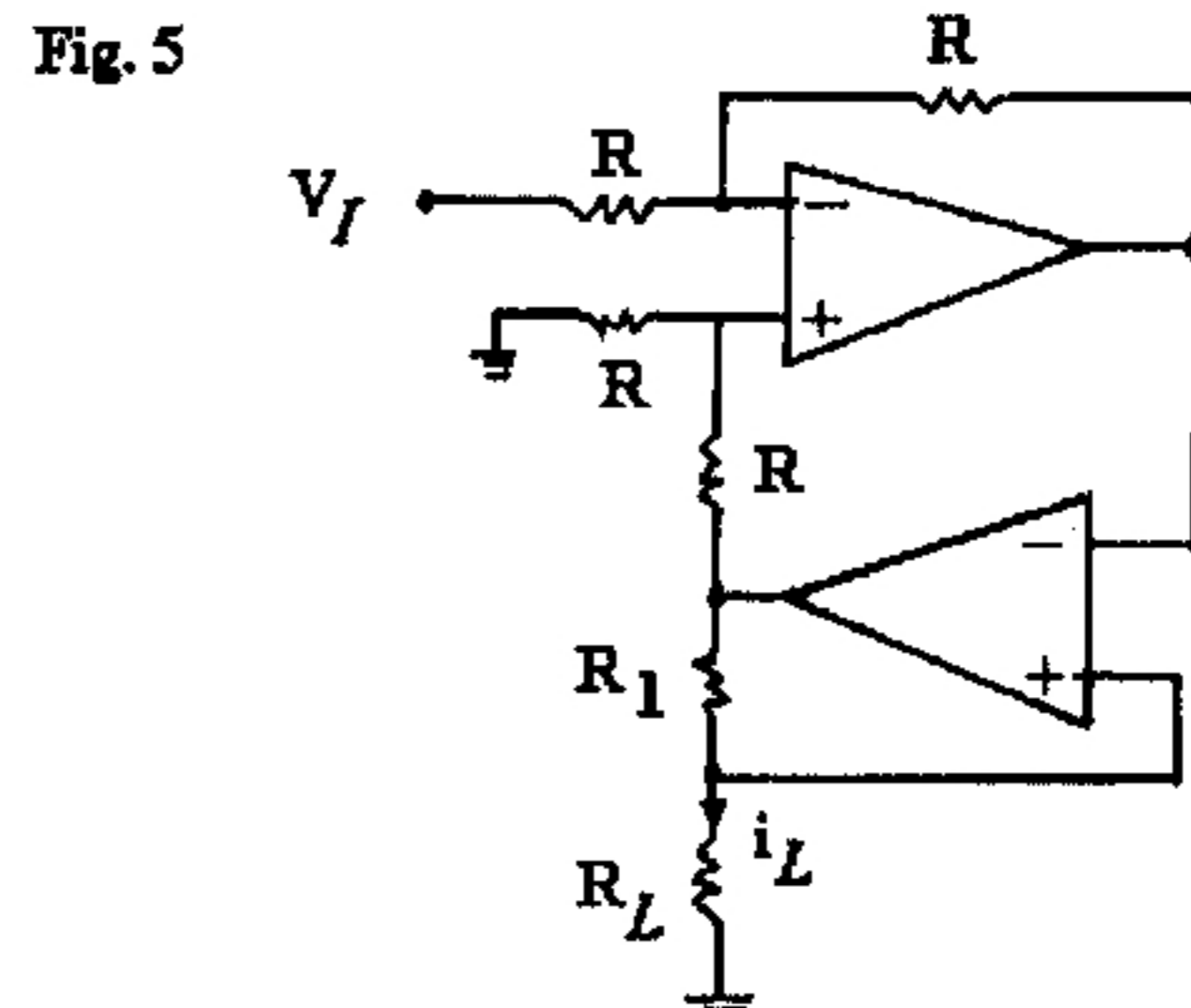
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5. The circuit shown in Fig. 4 is the primary of a switched power supply. The transistor is switched into saturation by a periodic pulse train, with each pulse having a duration γ_c . The transistor peak current should never exceed 2 amperes under no-load conditions. If $\gamma_c = 25 \mu\text{Sec}$, find the required value of L_p (inductance). (10%)



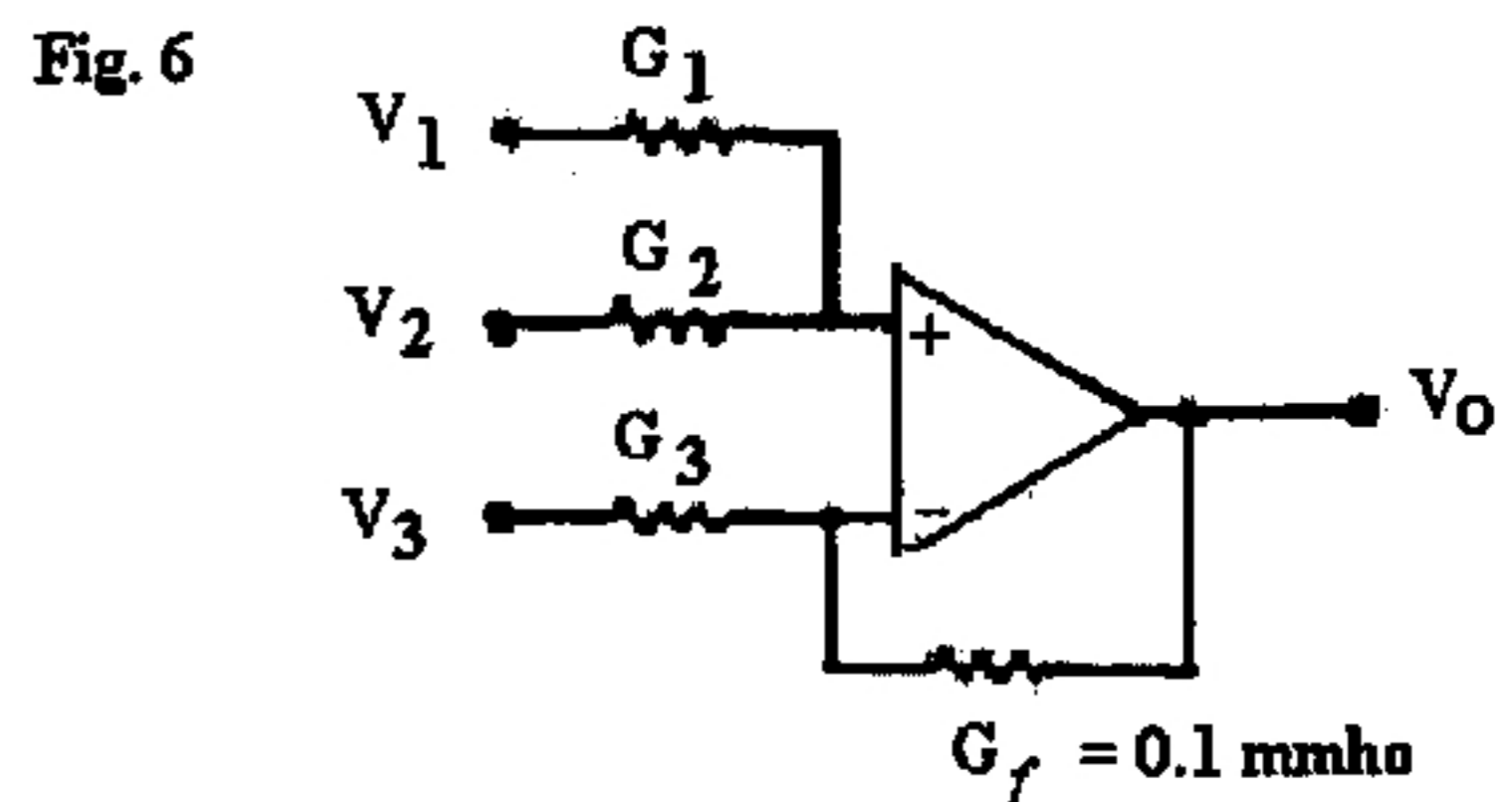
6. Assume ideal op-amps are used in Fig. 5. Calculate i_L in terms of V_I . What is the function of this circuit? (15%)



7. Design an OP amp circuit having the form shown in Fig. 6 and give

$$V_o = V_1 + 4V_2 - 4V_3$$

Take $G_1 + G_2 = G_3 + G_f$ to minimize output offset voltage due to input bias current. Find the values of G_1 , G_2 , and G_3 . (15%)



8. Using the OP amp-RC circuit to realize a first order high-pass filter with a corner frequency of 10^4 rad/s and a high-frequency gain of 10. Design the values of resistors and capacitor. Also show the circuit. Assume an ideal OP amp is used in this design. (15%)