*請依題號順序作答

一、多選擇題(40%，每題 10%，不倒扣，答案卷上需按題號答題)

1. The silicon is the most important material in the circuits and electronics. Which of the following statement is TRUE?
(A) The conductivity of silicon substrate is dependent of temperature since the carrier concentration increases with temperature. (B) The intrinsic silicon behaves like an insulator at very low temperature. (C) A common N-type semiconductor dopant is Boron. (D) Current in semiconductor is carried by free electrons and holes. Their numbers are equal and relatively small in intrinsic silicon. (E) The diffusion current I_D is carried by thermally generated minority electrons in the p material that are swept across the depletion layer into the n side.

2. The operational amplifier (Op Amp) is one of the most important circuit building blocks. Which of the following is TRUE for Op Amp?
(A) Generally, the Op Amp behaves like a current-controlled voltage source. (B) The ideal Op Amp has infinite open-loop gain and zero output impedance. (C) The ideal Op Amp has infinite frequency bandwidth with zero phase shift. (D) The input offset voltage V_{os}, is the magnitude of dc voltage that when applied between the OP Amp input terminals. When applied appropriate polarity, it reduces the dc offset voltage at the output to zero. (E) The maximum rate at which the OP Amp output voltage can change is called the slew rate.

3. The diode is the simplest and most fundamental nonlinear circuit element. Which of the following statement is NOT TURE?
(A) In the forward direction, the ideal diode conducts any current forced by the external circuit while displaying a 0.7V voltage drop. (B) The diode biased to operate at a dc current I_D has a small-signal resistance $r_d = V_T / I_D$. (C) Diodes designed to operate in the breakdown region are called zener diodes. (D) Rectifiers convert ac voltages into unipolar voltages. Full-wave rectifiers do this by passing the voltage in half of each cycle and blocking the opposite-polarity voltage in the other half of the cycle. (E) The dc restorer includes a capacitor; follow by a diode in parallel with the load.

4. Both biopolar junction transistor, BJT, and metal-oxide-semiconductor field effect transistor, MOSFET, are used widely in both discrete and integrated circuit design. Which of the following statement is TURE?
(A) For amplification applications, the BJT is operated in the active mode. (B) BJT is a good analog switch compared to MOSFET. (C) In MOSFET, the Common-Source (CS) has a reasonably high gain but a rather high output resistance and a limited high-frequency response, which is used to obtain most of the gain in a cascade amplifier. (D) While at low frequencies the gate current of the MOSFET is practically zero and the input resistance looking into the gate is practically infinite. (E) In both BJT and MOSFET, the early voltage V_A depends on the process technology and the dimension.

見背面

二、非選擇題 (60%)

1. (10%) Find V_{out} in the circuit of Fig. 1.

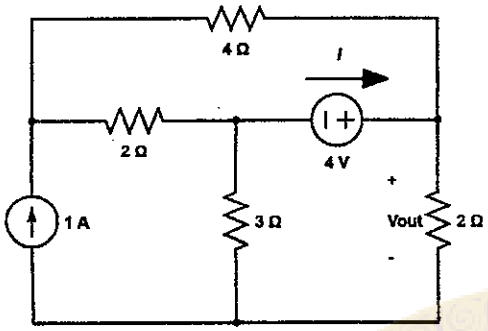

Figure 1

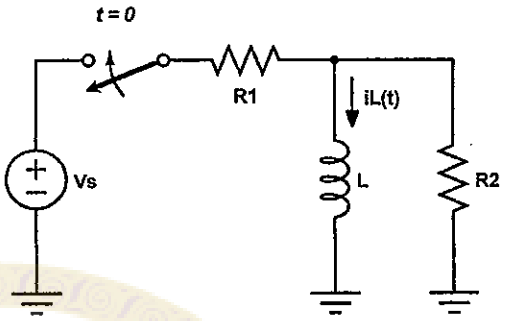

Figure 2

2. (15%) The inductor L in the circuit shown in Fig. 2 is the coil of a relay. When the current through the coil is equal to or greater than +2 mA, the relay functions. Assume steady-state conditions at t < 0. If V_s = 15 V, L = 10 mH, R_1 = 3 KΩ, determine R_2 so that the relay functions at t = 2.3 s.

3. (15%) The circuit of Fig. 3 demonstrates that Op Amp feedback can be used to create a resonate circuit without the use of an inductor. Determine the gain function $\frac{V_2}{V_1}$.

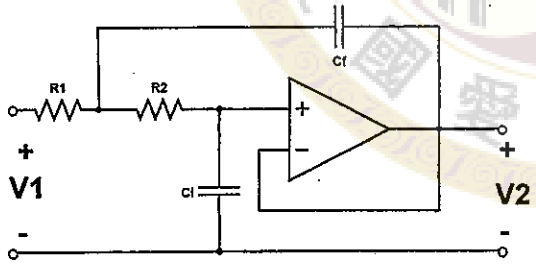

Figure 3

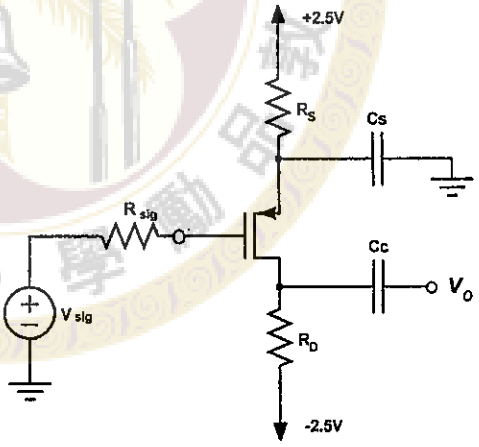

Figure 4

4. (20%) The PMOS transistor in the CS amplifier of Fig. 4 has V_{tp} = -0.7 V and a very large | V_A |.
   (a) Select a value for R_S to bias the transistor at I_D = 0.4 mA and | V_{OV} | = 0.4 V. assume v_{sig} to have a zero dc component.
   (b) Select a value for R_D that results in G_v = - 8 V/V.
   (c) Find the largest sinusoid $\hat{v}_{sig}$ that the amplifier can handle while remaining in the saturation region. What is the corresponding signal at the output?
   (d) If to obtain reasonably linear operation, $\hat{v}_{sig}$ is limited to 50 mV, what value can R_D be increased to while maintaining saturation-region operation? What is the new value of G_v ?

試題隨卷繳回